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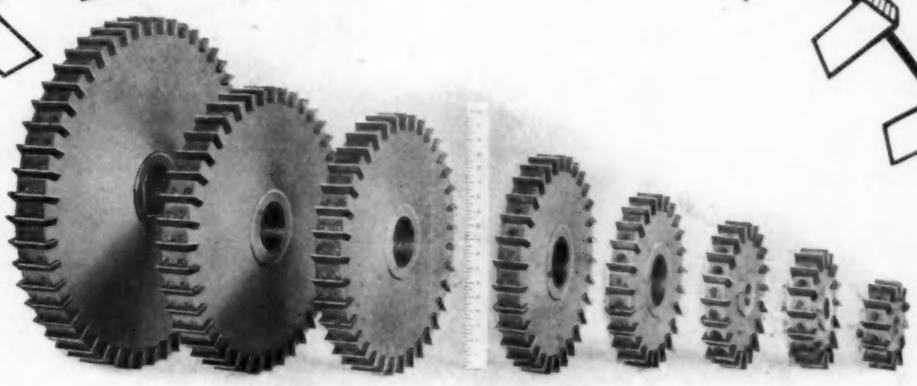
B&S·CUTTERS



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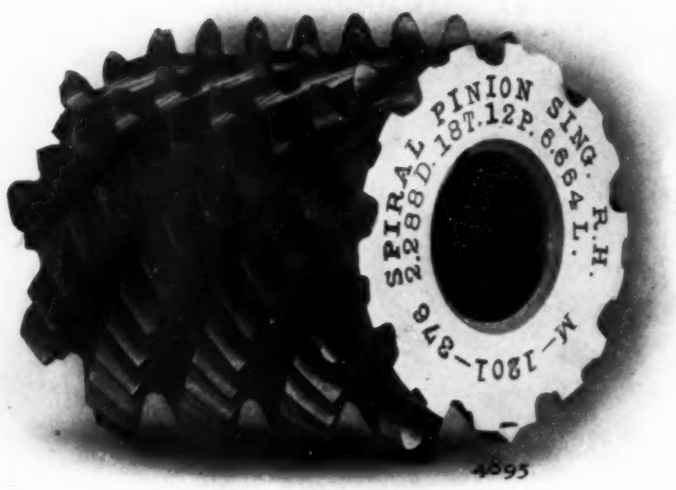

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A Collection of Old Sundials

By F. A. Halsey

Reminders of the time when clocks were not. Dials from ancient Greece and Egypt. Precision dials, pocket dials, dials that tell the time by the stars and dials that divide the day by strange and forgotten systems.

Former Importance of the Sun Dial

Few have any conception of the important place formerly occupied by the sundial, and yet it is clear that the necessity for knowing the time of day did not originate with the clock, which was the outgrowth of the need and not its cause. We may be very sure that men needed to know when to go home to dinner before the invention of the clock quite as much as afterward. To satisfy this need the sundial was the natural means and, in fact, is one of the oldest of human inventions. It assumed many forms exhibiting extraordinary ingenuity — more than would be believed possible when the simple nature of the instrument is considered.

To an American the word sundial conveys the idea of an ornamental affair mounted on a post in the middle of some gentleman's lawn and with a curious rather than a utilitarian interest. The idea of a large instrument placed at an elevation on a church tower or the side of a public building and intended to serve the purpose of a town clock, or of a small instrument to be carried in the pocket to serve the purpose of a watch, comes as a surprise, and yet, there was a time when such instruments were the chief means by which the time of day was told.

In Europe the erection of sundials by the side of the public roads began at an early date and by the sixteenth century they had become quite common. Many such public dials may be seen in England though not all of them are old as, in recent years, there has been a revival of the art which was in its palmy days during the first half of the eighteenth century. At this time it gave rise to a considerable literature in the form of technical treatises, many of which are still extant.

FIG. 1

Old Ways of Dividing the Day

Our present method of dividing the day into 24 hours originated with the Egyptians, from whom it came to us through its adoption by the Greeks and Romans. It is but one of several that have been and are still in use, some of which appear on the dials to be shown. Of systems not so shown there is the octimal in which the entire day—that is, a day and a night—was divided by successive halvings with 16 and 32 parts. This is even now used in Iceland, while the oldest sundial in England, which dates from the year 670, is divided in this manner. The entire day has also been divided into ten and twelve instead of 24 parts, the former system being still used in India and the latter in China.

Moreover, the practice of starting the numbering of the hours from noonday is not even today universal. The starting point has also been located at sunrise and at sunset—the latter system now prevailing in Mohammedan countries, where sunset is 12 o'clock. On the walls of Jerusalem there is a modern tower clock, one dial of which shows the time by the Christian and another by the Mohammedan system, though whether the constantly varying adjustment between the two is made automatically or by hand I do not know.

An Egyptian and a Hindu Sundial

It will thus be seen that the story of the sundial carries us into the far distant past, and of examples of old sundials the first to be shown in Fig. 1 is from the British Museum. It was found in 1852, near Alexandria, at the base of "Cleopatra's needle." It dates from the Ptolemaic period, say, from the first to the third century B. C. It is 16½ inches high, 17 inches wide, and 11 inches deep. The shadow casting member of gnomon is missing.

The form of the acting surface of this dial, unlike those of more recent times, is spherical, this being the original form of these instruments. While apparently more complex, it is in reality far simpler than the flat dial. The surface of the sphere is the reverse representative of the sphere of the heavens and with a gnomon located at the center of the sphere, the

hour lines become nothing but meridian circles located 15 degrees apart.

Between this and the flat dial a large growth in astronomical and mathematical knowledge is represented, and between them lies an intermediate form, the cylindrical, shown in Fig. 2, which is from a photograph of a small-scale model at South Kensington Museum, of an immense dial erected in India by Maharajah Sawai Jey Singh, an Indian prince who died about 1742. The dial, with a dozen or more astronomical instruments on a similar gigantic scale, all of solid masonry, still exists at the observatory of Jeypore. Scaling the model, I conclude that the gnomon of the original has a length of about 44 ft., while the cylindrical surface on which the shadow is cast has a diameter of 22 feet. The laying out of the hour lines of this instrument is as simple as in the case of the spherical dial, but, unlike that and like the modern instrument, the gnomon is required to be located in a direction parallel with the axis of the earth. Small dials of this form are still occasionally made and may be found in the instrument shops of London. They have the advantage over the flat dial, that by a simple adjustment, they may be adapted to any latitude.

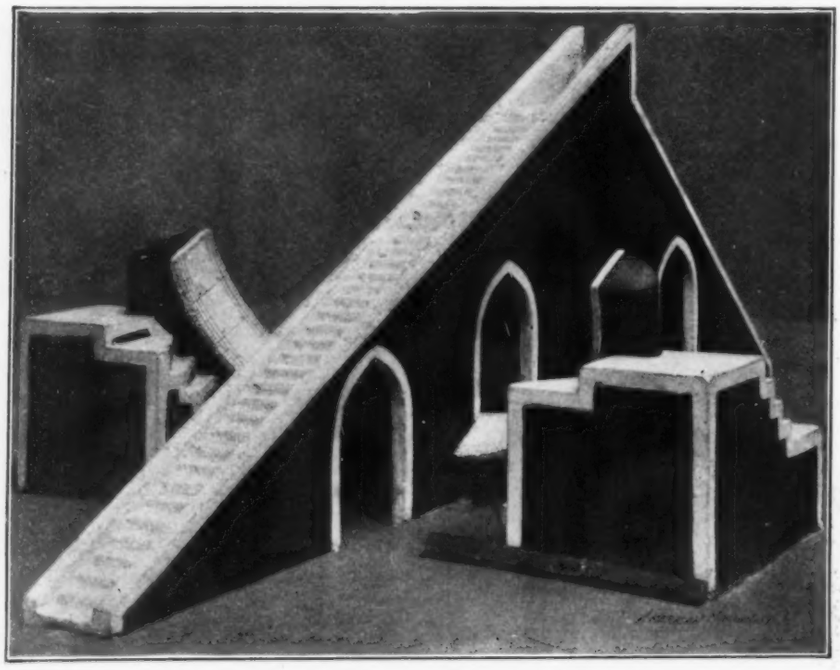

FIG. 2. A GIGANTIC HINDU DIAL

A GREEK SUNDIAL

Going back to the ancient dials, Fig. 3 represents another in the British Museum which was brought from Athens by Lord Elgin. It measures 39 inches long by 20 inches high. An inscription upon it in Greek states that it was made by Phaidros, an architect who lived in the second or third century A. D. The dial will be seen to be of the flat form and thus represents a marked increase in the knowledge of astronomy and mathematics.

It has several faces, each carrying a partial dial, a feature which in later times, and especially in Scotland, was carried to a much greater development. In the present case the two central faces make a complete dial. The line of intersection of these faces marks the noon hour, the shadow falling on one face during the morning, and on the other during the afternoon. Similarly the two outside faces form together a complete dial. The curves which cross the radiating hour line were intended, apparently, to mark the equinoxes, and the summer and winter solstices, when the days are equal in length to the nights and are of their greatest and least length respectively—these events being shown presumably by a bead or cross properly placed on the gnomon, which has disappeared. The curving of these lines so that the shadow will follow them throughout the day indicates some knowledge of applied mathematics, as well as of astronomy. In connection with this dial, it may be said that there stands in Athens a dial dating from classic days which, with a restored gnomon, still serves its original purpose.

One of the most interesting sundials in England is located at Hampton Court, where it has been standing since 1690. Exposure to the elements has so obscured its markings that attempts to reproduce it by both photographs and rubbings have proved failures. Its peculiarity lies in the fact that it gives mean or clock and not sun time, and while this has been done in other cases, I have not been able to find any trace of the same method used elsewhere. The hour lines or rays and their subdivisions, instead of being straight as usual are curved and, crossing them at substantially right angles, are a series of date lines which divide each month into ten parts of three days each. The rays being curved, the shadow of the gnomon crosses instead of coinciding with them, and each date line shows where the crossing of the shadow must be read for its date.

Another feature of this dial is that, whereas most others divide the hour into 15-minute intervals only, this one di-

2544
SUN-DIAL
MADE BY PHAEDRUS, SON OF ZÖILUS
OF THE PAEANIAN DEME.
ATHENS. [Brit. Mus. Gr. Inscr. N° 72, C.I.A. N° 427] Elgin Coll.
THIS PHAEDRUS WAS A MAGISTRATE OF ATHENS
ABOUT THE END OF THE 2ND CENT. A.D. [cm C.I.A. III. 233]

FIG. 3

vides them into 5-minute intervals. The great size of the dial shown in Fig. 2 permits this feature to be incorporated in it also. While we have no real knowledge of it, it is easy to conjecture that this Hampton Court dial was the outgrowth of the influence of a remarkable astronomical clock, which had been standing there for 150 years, when the dial was erected,* and we can readily understand the desire of the dialmaker that his instrument should give the same indications as the clock.

Two Precision Sundials

There are many other examples of the influence of the clock over the sundial, growing out of the fact that the clock had accustomed men to more minute divisions of time than those which the dials commonly gave. Thus Fig. 4 shows what we may call a precision dial, which was made in Austria about 1800 and is now in the remarkable collection at South Kensington Museum. The gnomon is here string. Its shadow does not fall directly upon the dial but upon a radial line (not visible in the halftone) engraved upon the rear end of the swinging arm which is pivoted at the base of the gnomon. This arm was adjusted until the shadow exactly coincided with the engraved line—an adjustment which could easily be made with considerable accuracy—and the time was read from the pointers at the large end of the arm, the inner pointer showing the hour and the outer pointer the minute—the outer circle being graduated to contain sixty divisions for each hour. The instrument is fitted with a compass, a plumb bob and leveling screws to aid in its adjustment.

Another and even more interesting precision dial is shown in Fig. 5 which, also, is from South Kensington museum. This instrument is of the equatorial type, which means that the plane of the dial, instead of lying horizontally, as usual, is adjusted parallel with the plane of the equator; in other words, with the axis of the dial pointing toward the Pole Star. To facilitate the adjustment, leveling screws are provided, together with a compass sunk in the recess of the face plate, and there is also an obvious means of adjusting the angle of the dial to the face plate. The gnomon is again in the form of a string located at the extreme upper right-hand portion of the instrument, while the upper surface of the oblong plate below the string carries an engraved mark parallel with the string.

In use the swinging arm was adjusted around the dial until the shadow of the string fell upon this engraved line, when the hour reading was taken direct from the pointer which traverses the large dial and which, in the illustration, points to the hour of one. The outer circumference of the dial carries a series of teeth, with which there meshes a pinion on the back side of the upper small dial, the staff of this pinion carrying an index hand, now broken off at about the middle of its original length, and which indicated the minutes engraved on the dial below it, this dial, as will be plainly seen, being divided into sixty divisions, and the ratio between the pinion and gear being such as to give a complete revolution to the index for every hour of the main dial. This feature is possible in the equatorial dial because in it, unlike the usual form, the hour lines are equally spaced.

This, like the preceding illustration, will indicate, in small measure, the high degree of ingenuity shown in these old dials—a feature which could not, however, be adequately treated without expanding this article to an unreasonable length.

Fig. 4. A Precision Dial Reading to Minutes

Vertical Dials

Of existing dials in England the most numerous are those which are located like tower clocks, but these are usually so far from the ground as to make the taking of effective photographs impossible. One of which I have been able to obtain a photograph is shown in Fig. 6. It is located on the Bargate of Southampton, where, as will be seen by its inscription, it was erected in 1705—the letters at the top being the initials of John Thornbury, the then mayor of the city. The date refers to the dial only. The Bargate is part of the original walls surrounding the city, of which large portions remain and which date from the 11th and 12th centuries. Judging by the eye the dial is about two feet wide by

*The dial of this clock is still in use, although the original works have been superseded twice. The dial shows the hour, the month, the day of the month, the day of the year, the position of the sun in the elliptic, the phase of the moon and its age.

three feet high and it is of the same service today as when put up. The Bargate, of course, crosses the street where it is erected and the dial may be read from a considerable distance.

Another fine dial of which, because of its large size—about 8 square feet—and nearness to the ground, I have been able to get a satisfactory photograph, is shown in Fig. 7. It is located within the quadrangle of Brazenrose College, Oxford University. Except that it is larger than most others it is a typical illustration of many dials, ancient and modern, that exist in England. That they are objects of interest and ornament as well as usefulness is obvious. This example dates from 1719, though, as is obvious, it has been repainted and no doubt otherwise restored. The hours are divided into halves, quarters and eighths, the smallest interval representing 7½ minutes. Another similar example which is nearly as large, though circular in form, stands within the quadrangle of All Souls College, Oxford. It is due to Sir Christopher Wren.

Portable Dials

In addition to large permanent dials there was great activity in the making of portable dials to be carried in one's pocket and to serve the purpose of a watch. There are many examples of these in both the British and South Kensington Museums. The favorite construction consisted of two plates of ivory hinged together like a book and carrying a string between them which served as a gnomon. Two fine examples from South Kensington Museum are given in Fig. 8, of which the one at the left dates from 1589 and the one at the right from the seventeenth century. The dials are fitted with compass needles in order that they might be properly adjusted, as plainly shown in the illustration, the variation of the compass from the true north being properly indicated.

Several holes will be seen down the middle of the upper leaf of the left-hand dial, with numbers—54, 51, 48, 45, 42 and 39 spanning them. These figures represent latitudes and the holes are the proper locations of the string for the latitudes indicated. Since each latitude requires its own layout of the dial, the hour lines or the rays are broken in concentric circles, each correct for a latitude, the correct circles for the various latitudes being shown by figures corresponding with those on the upper leaf but too small to be read in the halftone. On the back of the upper leaf is a table of latitudes of important towns.

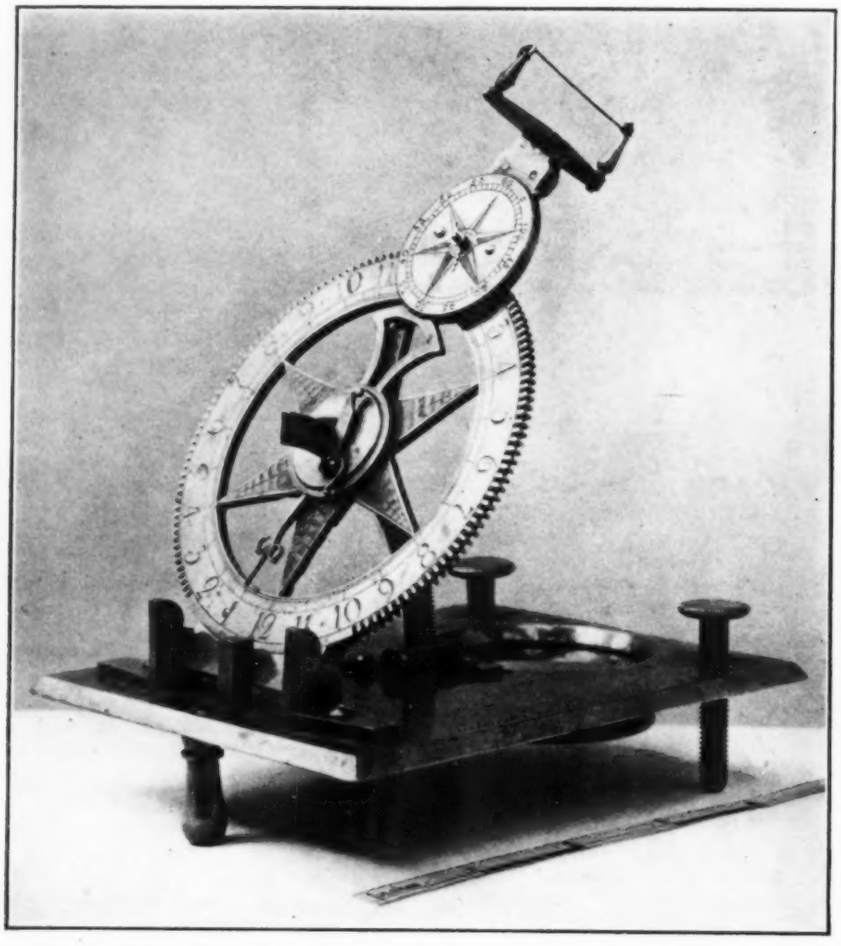

Fig. 5. Another Precision Dial

These dials tell a lot of other things. The upper leaf of the left-hand instrument contains diagrams, of which the lines are marked with the familiar signs

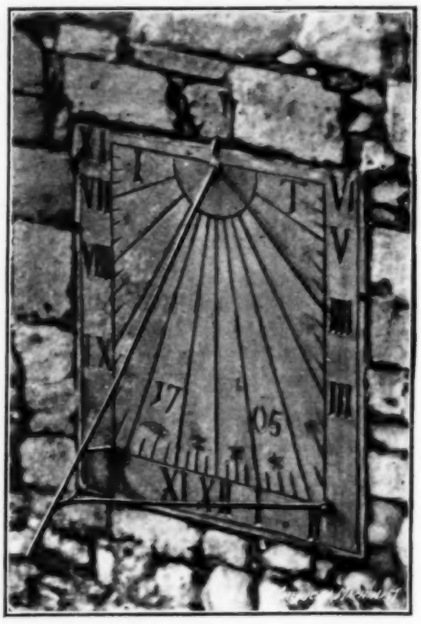

Fig. 6. A Public Dial at Southampton

of the zodiac, and above the diagrams are gnomons, apparently reduced from their original length. The line on which the end of the shadow of the gnomon falls shows the position which the sun occupies in the ecliptic, while the figures on the lines show the number of hours between sunrise and sunset. The two diagrams are for different latitudes, as indicated by the figures below, although each diagram is a compromise for a rather wide range of latitudes. In the foreground of the lower leaf are two saucer-shaped dials which give the time counted from sunset by a system in which the entire day is divided into 24 hours, numbered consecutively up to 24.

A moment's reflection will show that the construction of a dial to read according to this system is far from simple. As the sun appears above the horizon the shadow cast must at one time of the year indicate 10, at another 12, and at another 14 o'clock and, moreover, counted from a starting point which itself constantly changes.

Directions for use in Latin appear on the lower part of the upper leaf.

The upper part of the upper leaf of the right-hand dial gives the same information as the diagrams at the top of the left-hand instrument, and in addition, by the radiating straight lines, it gives the hours counted from sunrise by a system which divides the time from sunrise to sunset into twelve hours which vary in length with the length of the day—a system which was formerly in large use and which is the easiest of all to which to lay out a sundial. Below this diagram

is a vertical dial, which, like the circular horizontal dial gives the time in the now common way. The saucer-shaped dial in the foreground is similar to the corresponding dials of the left-hand instrument, although containing some lines which like the dial in the outer margin of the lower leaf I am unable to understand.* The back of the left-hand dial contains the necessary information for obtaining the time from the shadow of the moon, while the back side of the right-hand dial carries fixtures for telling the time from the stars, as will be explained later in connection with another instrument. The circular dial in the center of the upper leaf is part of this star dial.

A Gem of a Dial

Of these portable instruments the neatest that I have been able to find, and it is certainly a gem, is shown in Fig. 9 which is from a pocket dial in the British Museum. The instrument will be seen to be inclosed in a case very similar to a watch case, of about the same size, and as convenient as a watch for carrying about the person. It dates from 1705.

The gnomon is pivoted at its base, in order to fold flat when the case is closed, and below it is a key-staff and scale, the use of which I can only infer, as I was not permitted to remove the instrument from the exhibition case for close examination. This inference is that the graduated scale refers to latitude, and that the squared staff carried originally a pointer traversing the scale, and that by turning the staff a stop below the dial was adjusted to locate the gnomon at an angle suited to the latitude indicated on the scale. With a single dial for all latitudes this adjustment could, however, be approximate only.

Star Dials

This article has already stretched far beyond the limits originally intended, but I can scarcely refrain from remarking that, the usefulness of the sundial being limited to the hours of daylight, our forefathers were equally resourceful in devising means for obtaining the time at night. The moon was pressed into service as already indicated, although the absence of the moon for so large a portion of the time made this unsatisfactory and led to greater activity in the construction of star dials or nocturnals, which were sometimes combined with sundials as in the case of Fig. 8. More often, as in the case of Fig. 10, which shows one of several star dials at South Kensington Museum, they were entirely independent. In use the arm marked *"Index Solis"* (solar index) was first adjusted to the proper day of the month as shown in the outer graduated circle. The instrument was then held as nearly as possible parallel with the plane of the equator, the North Star was sighted through the central hole, and, the instrument being held in the same position, the projecting radial arm was adjusted to the line of the Pointers of the Dipper, when the time was read from the crossing of the edge of the long index and the hour circle at the outer edge of the inner circular plate. Within the monthly scale are the signs of the zodiac, each one divided into 30 degrees, the crossing of which by the solar index gave the position of the sun in the ecliptic. There is also a lunar index and within the hour circle a scale divided into parts representing the number of days in a lunar month, while within the lunar index is a hole intended apparently to show the phases of the moon. Just how these parts were used I am unable to make out. The instrument dates from 1543.

*These explanations are largely matters of inference. If any reader of the AMERICAN MACHINIST can supply omissions or point out errors I should be glad to have him do so.

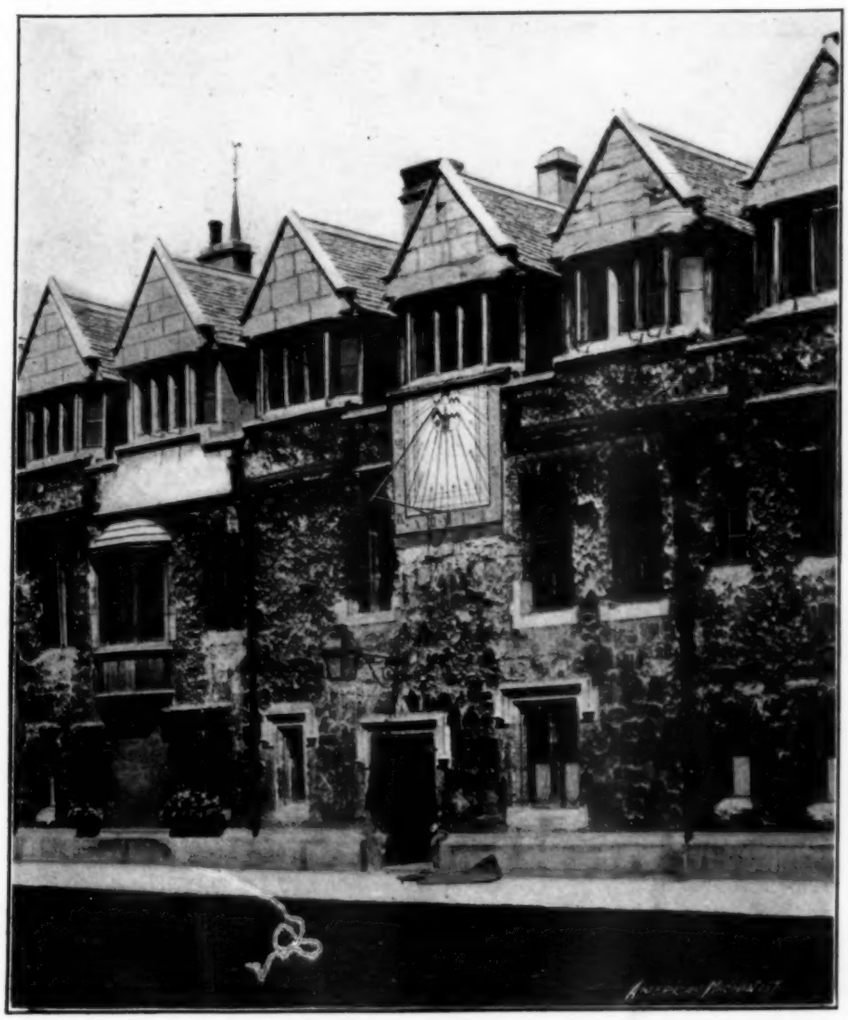

FIG. 7. A FINE DIAL AT OXFORD UNIVERSITY

The Unstable Equilibrium of the Balloon

BY TECUMSEH SWIFT

The prominent and popular engineering problem of the day is that of aviation. It has attacked the mechanical brain of the age and must work itself out, to results perhaps not yet in sight. Probably more of the readers of the AMERICAN MACHINIST are thinking and talking upon this topic than upon any other, and it would seem to be eminently improper, if not impossible, for their favorite journal to ignore it, so that I feel that I need not offer an apology for my say on the subject, my only regret being that what I can tell in my present lucubration is almost entirely about how not to do it. This is, however, the first and most necessary thing to know in any case. The earlier history of any laboriously wrought success consists largely of the story of elimination, and generally of the practical abandonment of everything first tried or thought of. The elimination of the essentially worthless devices in aviation means a saving of time, of money and of life.

Wonderful is the perfect poise of the fish in the water, yet the devices by which it is maintained, though marvelously ingenious, are of the simplest character. The most alert and swiftest fish of prey with

which we are acquainted, such, for instance, as the pike or the pickerel, seem to spend much of their time almost absolutely without change of position, watching and waiting in readiness to dart, as upon land the cat watches the bird or the mouse.

A submerged body charged with life forces and floating inert in the water is apparently free to move or to be moved in any direction, and that it should not is the most unlikely thing that would probably be predicted of it; yet fish seem to be provided with the means of resisting or of counteracting the minutest disturbing forces and to be able to maintain their position when so desired apparently without effort, and in fact almost automatically, so that they seem even to sleep as if anchored.

To retain its position vertically, so that it will neither rise nor sink in the water, the body of the fish as a whole must have precisely the same specific gravity as the water which surrounds it, and means must be provided, and they are, for instant adjustment and correction of the specific gravity. The air bladder of the fish, normally filled with compressed air, is a device for the purpose which for simplicity, precision and effectiveness challenges the inventive faculty to surpass it. The air in the fish bladder must be always under more or less pressure, and the elasticity of it opposes a constantly maintained muscular tension in the body which incloses it. When the muscular tension is increased the air is still more compressed, giving the bladder a diminished volume, the entire body of the fish in which the bladder is inclosed is correspondingly reduced in bulk, so that while its actual weight remains constant, its weight relatively to the weight of water displaced is increased and the tendency of the fish-body is to descend in the water. On the other hand, if the muscles which hold the air bladder and its contents in compression are relaxed the body of the fish will be distended and the fish will tend to rise in the water. When fish are not well and have not the strength to maintain the compression they float to the surface. If a mermaid in a ball room of the deep should faint away she would not sink to the floor but would float to the ceiling and become entangled among the chandeliers.

The air bladder of the fish has a still more delicate and responsible function than that of merely maintaining the pre-

FIG. 9. A GEM OF A POCKET DIAL

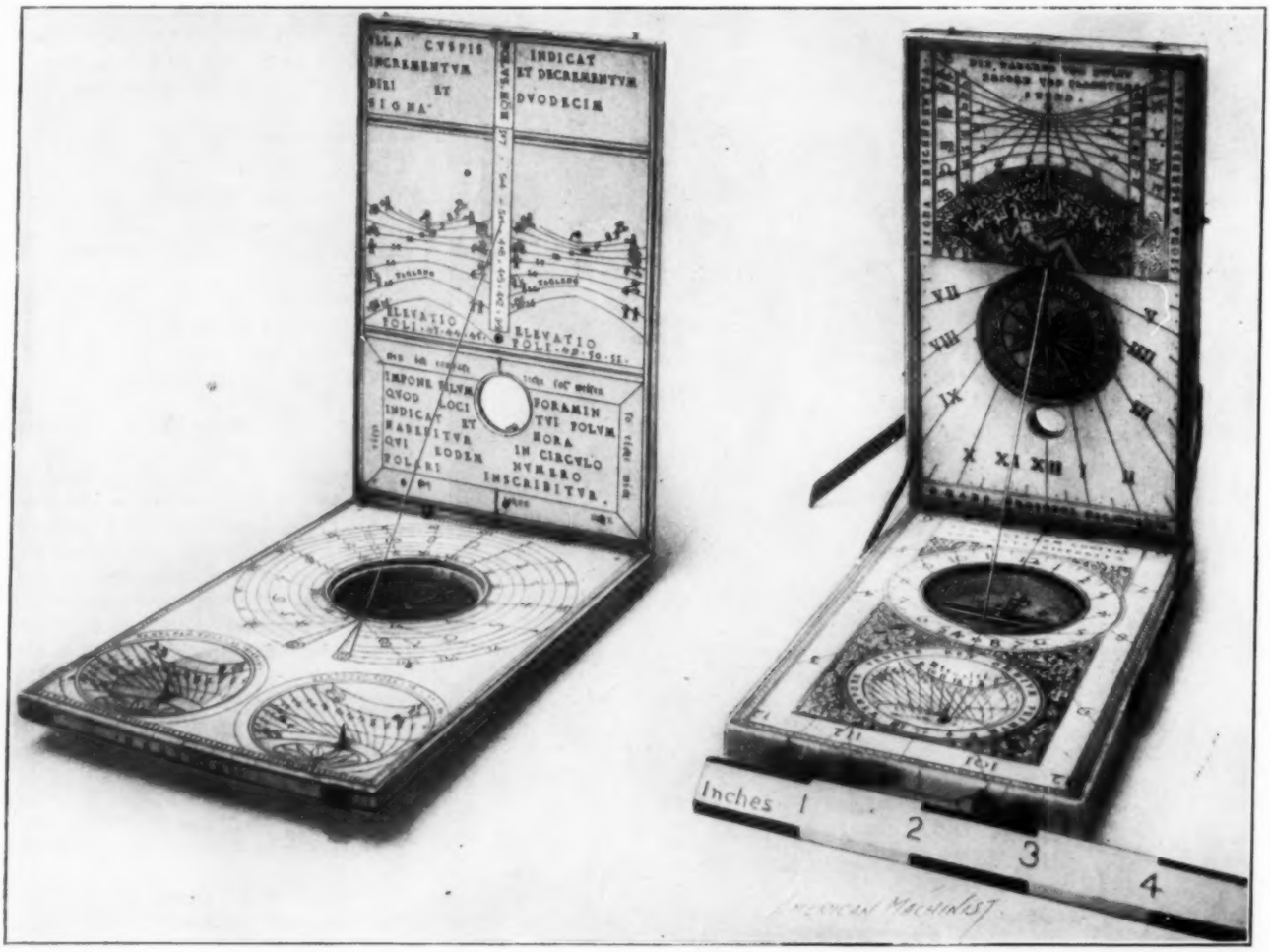

FIG. 8. TWO EXAMPLES OF POCKET DIALS

cise specific gravity of the body. The stability of the fish laterally in the water is assured by the fact that the air bladder is located high in the body and the preponderance of weight is below it. The longitudinal, or fore-and-aft, trim of the fish is more difficult to adjust and maintain, as builders and operators of submarines have learned. This also the air bladder perfectly provides for, it being made of considerable length relatively to its diameter and also proportioned transversely or formed into two chambers, the muscular control of the fish transferring air from one chamber to the other as may be required.

The fish floating in liquid of uniform and unchanging weight and density is thus perfectly equipped, with slight local adjustments by the aid of the fins, for maintaining its position and poise as desired. The problem of stability in the air is a still more difficult one, if not, indeed, impossible of solution, as we might learn by the hint which nature gives, all birds being of the "heavier than air" type.

Man, however, has not been deterred from trying it, and has had absurd experiences in consequence. More than a century ago balloon ascensions began and they still continue, and it cannot be said that in all these years, and with the modern dirigible before us, much has been accomplished toward the attainment of the impossible in this direction.

The balloon ascensions with which the last century made us familiar were practically all alike. There was the gas bag and the helpless mortal in the basket below it. There would be too much gas to begin with and lots of ballast. Starting with levity sufficient to carry the balloon rapidly upward, so that it would clear all terrestial obstructions, it would continue to rise beyond the desirable limit of flotation because the air in the bag expands correspondingly with the reduced atmospheric pressure outside of it. If the balloon was full to begin with some of the gas would be forced out of the neck, sometimes asphyxiating the aëronaut. Normally, however, the correct practice would be to let out some of the gas, continuing this until the ascent was stopped. By the time that it could be ascertained that the balloon had ceased to ascend it would really be descending with more or less rapidity and to check the descent ballast would have to be thrown out, this operation also being carried to excess before the results of the action could be determined. Then it would be let out more gas, then throw out more ballast and so on as long as the game could be kept up, the last result being always to come ignominiously to earth upon any spot which the shifting winds might determine, and never to be hopelessly lost in the sky. This certainty of coming to earth in the end has doubtless saved many more or less valuable lives.

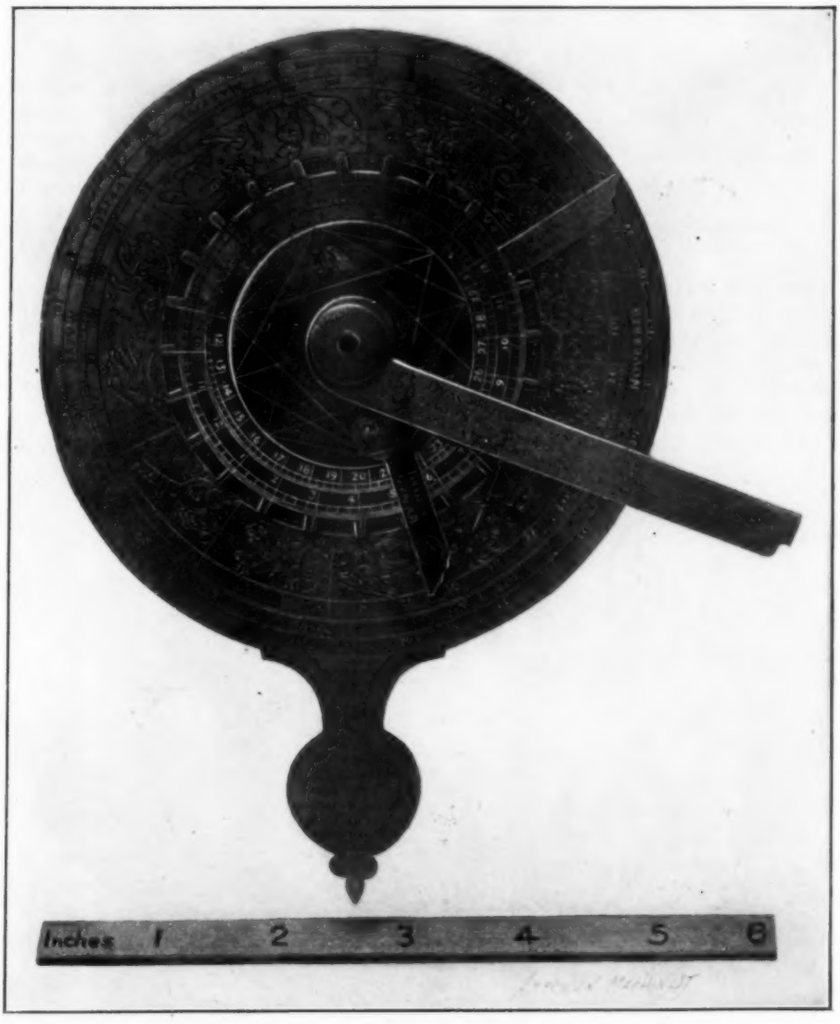

FIG. 10. A DIAL FOT TELLING THE TIME FROM THE STARS

While these ups and downs of the balloon were going on other agencies would have their persistent effects. There would be constant changes of temperature, and consequently of the volume and levity of the gas, from the shining of the sun alternating with its obscuration from passing through different currents and strata of air. Sometimes the vast surface of the balloon would be dry and sometimes it would be heavily laden with moisture or actually wet with rain or even laden with accumulations of ice or snow, and then there would be more or less leakage or the interchange of air and gas continuous over the entire surface.

The dirigible balloon is still a balloon and subject to most of these balloon conditions and incidents. It is entirely a balloon and only slightly a "dirigible." It must wait upon the fickle winds and can never oppose them. Under conditions the most favorable and seldom concurring it cannot of the best attain the speed of land conveyances. Of what possible use can it ever be except in some unforeseeable contingencies of warfare? For gambling purposes it would seem to be the ideal instrument, it involving so many elements of absolute uncertainty which can be neither predicted nor controlled.

While there are so many still scheming for perpetual motion the balloonists, dirigible or otherwise, are not to be wondered at, but they would seem to be of the same type of visionaries, and suggesting similar consideration and treatment.

The balloonist John La Mountain more than fifty years ago had a theory of an easterly air current which should carry him to Europe. He landed in the dense woods of the far northern Canadian wilderness, and he nearly starved to death before he worked his way out. Poor André started for the Pole, upon what theory nobody knows, and where he landed also nobody knows. At the present writing there is talk of flight to Europe by dirigible. While there is a law against suicide why should not such an attempt be preventable, at least until a flight of equal extent has been made over the land?

[The above article was written and presented before the start of the Wellman trip.—ED.]

Cutting Gears on the Slotter

By A. Wood *

A method of machining large gears of any pitch on the vertical slotting machine, using a special index spider for each size of gear ring. Equipment which is equally serviceable for either internal or external gears.

How the work is mounted and indexed from tooth to tooth as fast as each space is cut with a form tool in the slotter ram.

*Chief draftsman, Niles Tool Works.

Large gears, those larger than can be handled on an ordinary rotary gear cutter, may be accurately and economically cut in a slotter. The Niles Tool Works, Hamilton, Ohio, have built slotters using the patterns of their heavy forge type machines and have equipped them especially for cutting their largest internal and external gears. Fig. 1 shows one of these 16-inch stroke machines with a finished external gear in place. The tool is driven by a direct-connected motor mounted on the back of the machine.

How the Work Is Mounted

Gear rings of the type shown in Fig. 1, whether for lathe face plates or for boring-mill tables, are mounted for the machining of the teeth, upon an index spider shown in Fig. 2. The gear is bored out to fit a shoulder turned on the spider as indicated by the sketch Fig. 3 and as will be noticed the spider rim is provided with drill bushings and the spider thus serves as a jig for drilling the holes in the gear ring. The gear ring itself acts as a jig for drilling the face plate or table to which it is to be permanently attached. Fig. 3 shows the gear and indexing spider fastened together with bolts which fit the hole in the ring and the bushing in the spider.

It will be understood that the gear ring is turned externally and faced at the same setting on the boring mill as used for the boring of the internal flange which fits the shoulder of the indexing spider. Also, while the work is on the boring mill, lines are scribed around the blank ring indicating the pitch circle and the bottom of the teeth, these lines being used later to facilitate the cutting of the teeth to the correct depth in the slotter.

The Index Spider

Ordinarily a special index spider is made for each size of gear to be machined and these spiders are usually made of practically the same diameter as the gear. The indexing notches are rectangular in form and are also cut on this type of slotter. They are laid out by spacing accurately, and, where possible, the number of notches is divided by say 4, 6, 8, etc.; thus the accuracy of the spacing is readily checked by computing the chord across a number of divisions and then measuring the distance to see if it corresponds with the dimension obtained by calculation. With the spiders correctly laid out for the required number of index notches these notches are cut through, care and judgment, of course, being exercised in the operation.

The locking bolt for the spider is controlled by a spring which forces it into place in the notches and is drawn back to release the work by a lever shown projecting near the right-hand side of the gear ring. The gear and the index spider are mounted upon a central pivot and the work may be readily revolved by the hand when the locking bolt is withdrawn from the index spider.

The Work Table and Support

The slotting machine illustrated is equipped with a special table, long and narrow in its proportions, and having at the sides two stiff wings which are detachable and which may be replaced with other extension pieces of greater or less length according to the nature of the work. For mounting gears which are beyond the capacity of this table with its extended arms, three special pedestals or jacks are utilized for carrying the projecting portion of the work. These jacks and the floor plates upon which they rest are clearly shown in the halftone, Fig. 1.

Capacity of the Equipment

Some very large gears have been machined with this equipment. One of these was 20 feet in diameter and 1 diametral pitch or 3.1416 circular pitch. This gear had 240 teeth. On the other hand the machine has been found equally serviceable for certain pinions of relatively small diameter. Where a special form of tooth is required in a pinion, it is sometimes found more economical to make a formed tool for the slotter rather than a formed milling cutter. Furthermore, certain types of pinions have been planed in this fashion where the rotary type of cutter would not be applicable. Such a pinion is illustrated by Fig. 4, which shows a special driving pinion with staggered teeth, the teeth in one portion of the pinion coming in line with the tooth spaces at the other end of the pinion. The large gear operated by this pinion was made in one piece with similarly staggered teeth, the idea in this design being to secure a driving effect similar to that obtained with spiral gears.

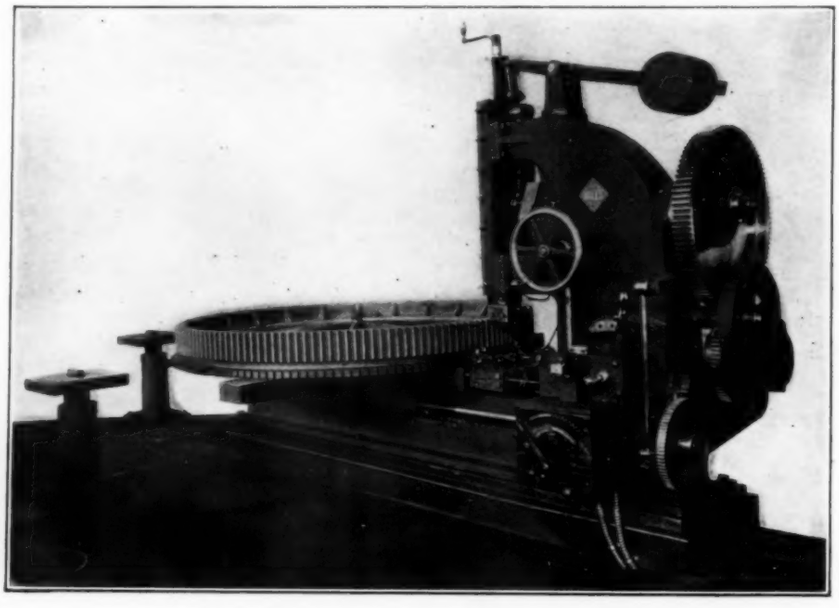

Fig. 1. Slotter Equipped for Cutting Gear Teeth

The tool holder carried by the ram of the slotter is arranged for relief in either direction and the tool, therefore, is relieved on the up stroke regardless of whether the work being cut is external or internal. The gear blank is fed by power under the tool until the tooth space is well down toward proper depth. Gages are used for testing the depth of each cut to insure the required degree of accuracy.

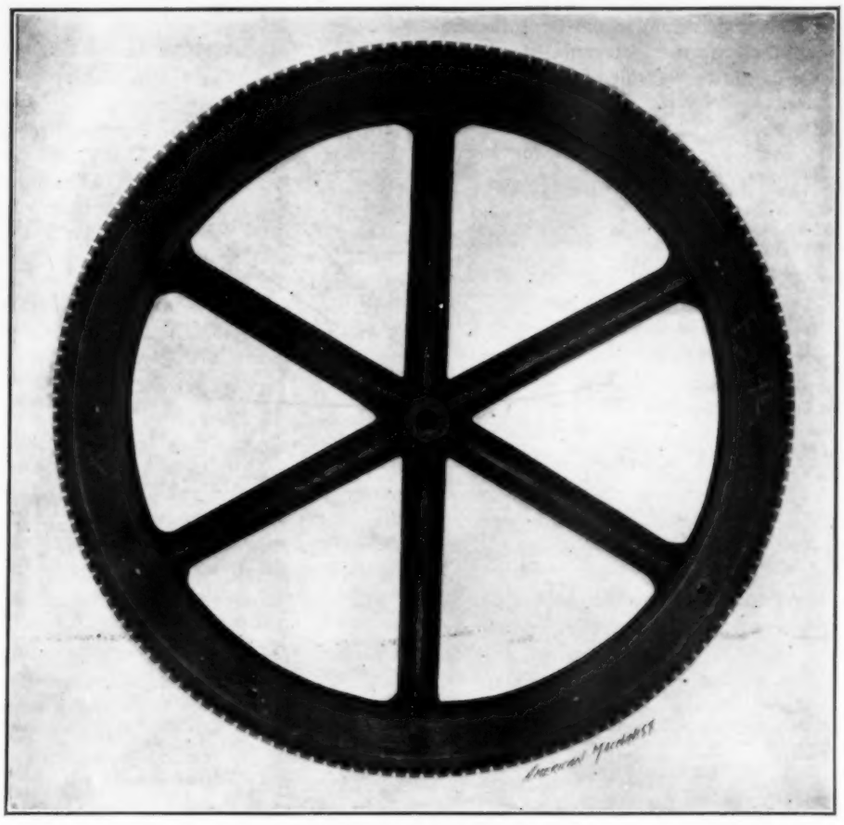

FIG. 2. THE INDEX SPIDER

The outside diameter is 14.4 inches and the tooth face at each end 3¼ inches wide. An index spider with special form of hub was made for this job and twice as many notches were cut in its periphery as there were teeth required in the work.

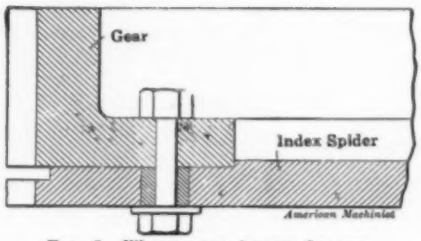

FIG. 3. WORK AND INDEX SPIDER

The index spider was then operated two notches at a time for spacing the teeth at one end of the pinion blank, after which the spider was turned one notch to bring the work into the proper position for cutting the tooth spaces in the other portion of the blank opposite the teeth already finished.

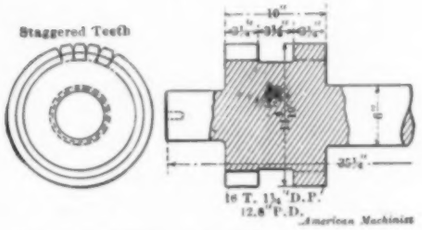

FIG. 4. DOUBLE DRIVING PINION WITH STAGGERED TEETH

The automobile industry, according to the United States Department of Commerce and Labor, is the fifth industry of the country in the amount of capital invested and value of production.

Hourly Cost of Running Machinery

By D. C. Eggleston

All of the expense items, fixed charges, rent, power, administration, tools and sundries are analyzed to give ratios—per machine, hour or operator as the case may be—and these ratios applied to machine cost, floor space occupied, kw. hours of electric current used, number of operators and type of machine give the yearly expense. This amount divided by the yearly hours of operation gives the hourly machine expense rate—in the case cited $0.16, for a No. 2 milling machine.

A large machine shop which was situated in a city kept its supply of material at public stores and so was able to use its floor space almost exclusively for manufacturing. Expenses incurred by the shop for fixed charges, rent, power, administration, tools and sundries were generally known as "machine expense" to indicate the separation from the prime costs, labor and material. This last item included incoming freight, cartage, and warehouse charges. Figuring costs was therefore a simple matter when once the hourly cost of running machinery was known.

FIXED CHARGES, (A) DEPRECIATION

This company, which we will call the Enterprise Manufacturing Company, had kept records of its machinery for a great many years and from experience they were able to compile tables showing the longevity and obsolesence of various classes of machinery. The results were incorporated into a depreciation table and showed that miscellaneous and productive machinery depreciated at the rate of 12½ per cent. of the residual value.

The rate may seem high, but this was due to the fact that there had been a constant change in the public demand for their product which necessitated continual adjustments in their equipment. The relative amount of depreciation in the fixed charges is shown in Chart 1, the size of which shows the importance of correct depreciation rates.

FIXED CHARGES, (B) INSURANCE

When an insurance premium was paid a card, Form 1, was made out; a complete description of the policy was written on the front of the card and the monthly expiration on the reverse. These cards were provided with tabs showing the month of expiration. The insurance actually used each month was charged to "machine expense" the relative amount

Policy No.	Date
Term	Expires
Property	Location
Amount	Premium
Rate	
Company	Broker

Premium			Monthly Rate		
Date	Am't	Bal.	Date	Am't	Bal.

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FORM 1. JOURNAL RECORD

of which is shown in the fixed charger Chart 1. It was customary to cover 80 per cent. of the investment by the policy.

Fixed Charges, (c) Taxes

Monthly one-twelfth of the amount of the year's taxes was charged to "machine expense." The sum of the depreciation, insurance and taxes for one year divided by the investment in machinery gave the fixed charges ratio to be used in distributing fixed charges.

Location, Building A — Machine No. 30
Group, 19
Description, Hand Screw Machine No. 2

Area Obstructed	40.	Cost	$285.
Kw. Hrs. Trans.	1175.	Belt to Countershaft	16.
No. of Operation	1.	Belt Countershaft to Main Line	18.
Tools Ex.	240.	Countershaft	20.
Sundry Ex.	25.	Pulley on Main Line	6.
		Labor Installing	5.
		Total Cost	$350.

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Form 2. Machine Record Card

Rent Charges

Everyone is familiar with the way offices are rented at a rate to include not only the use of the rooms but also service such as that of sweepers, cleaners, watchmen, elevator men, house telephone, drinking water, ushers, light and heat. In an analogous manner the Enterprise Manufacturing Company classified such charges under the head of "rent" in "machine expense." The sum of such items divided by the total available square feet of floor space gave the rent ratio to be used for the distribution of rent charges. In the rent charges Chart 2, the ratio is shown to be 50 cents per square foot.

Power Charges

It appeared at the Enterprise Manufacturing Company that the cost of generating steam power was transferred to the electric-current generating system. That, in turn was charged to the electric current distributing system and finally transfers were made to the electric-current transmission system. Thus from the generation of steam to the final distribution of power the accumulated charges were carefully classified and finally appeared as "electric current transmitted." Reference to Chart 3 shows that it cost 5½ cents per kilowatt hour for electric current transmitted.

Hourly Cost Record

Group No. 19 — 4 - No. 2 Milling Machines

Data per Form 3		Ratios per Charts	Machine Expense Amount	Machine Expense Classification
Cost	$ 1,415.00	0.06	$ 84.90	Fixed Charges
Area	160 Sq. Ft.	0.50	80.00	Rent
Elec. C. Trans.	4700 K.W. Hrs.	0.055	258.50	Power
No. of Oper.	4	50.00	200.00	Administration
Est. and Analy.	$ 960.00		960.00	Tools
Est. and Analy.	$ 100.00		100.00	Sundry
Total Machine Expense			$ 1,683.40	
No. of Machines in Group			4	
Yearly Cost per Machine			$ 420.85	
Yearly Average Hours of Operation			2630	
HOURLY COST			$ 0.16	

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Form 4. Hourly Cost Record

Group 19 — No. 2 Milling Machines

Shop No.	Cost	Area in Sq. Ft.	Kw. Hrs. Elec. Trans.	No. Oper.	Tools	Sundry
30	350	40	1175	1	240	25
31	350	40	1175	1	240	25
32	360	40	1175	1	240	25
33	355	40	1175	1	240	25
Total	1415	120	4700	4	960	100

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Form 3. Machine Group Record Card

Administration Charges

Salaries of superintendent, foremen, foremen's clerks and cost clerks were classified under "administration" in the analysis of "machine expense." Any expenses incurred by those whose salaries were charged "administration" were also charged to this division of "machine expense." The amount of "administration" expense divided by the number of productive operators in the shop gave the ratio to be used in the distribution of this division of "machine expense." See Char 4.

Tools Charges

A great many of the expenses in a large machine shop are directly connected with the maintenance of the small tools, jigs and shop fixtures. There are also many expenses incurred in connection with oiling, setting up and transferring machinery all of which were classified as "tools expense" in the analyses of "machine expense." In order to find out the exact amount chargeable to a single group it was necessary to estimate and analyze the various items carefully. See Chart 5.

Sundry Charges

Items of expenditure for which no other classifications were provided were charged to the "sundry" division of "machine expense." Reference to Chart 6 will show the nature of "sundry expense" and the necessity for a careful analysis in order to arrive at the division by groups of similar machines without which division it is impossible to arrive at the hourly cost of running machinery.

Machine Records

There were a great many departments, each of which consisted of a group of similar machines. The following is a list of the "main classifications" which were sub-classified according to the capacity of the various machines:

Lathes; screw machines; milling machines; drill presses; grinders; buffers and polishers; tappers; punch presses; shears; shapers; saws; sanders; mortising and tenoning machines; bench work.

As each machine was purchased it was assigned a number and a record made on the machine record card, Form 2. Facts regarding machines of the same group were entered from the machine record cards on Form 3 which gave complete information regarding a group. Miscellaneous machinery such as cranes, air hoists, trolleys, etc., were recorded on Form 2 and if used in connection with a numbered machine the fact was noted.

Hourly Cost

The last step in arriving at the hourly cost of running machinery is to fill in the hourly cost record, Form 4. For purposes of illustration the cost of running a No. 2 milling machine is found. The data on Form 3 is copied on to the hourly cost record, as shown. Reference to the fixed charges Chart 1 shows that the fixed charges are equal to 6 per cent. of the face value of all machinery. The face value of one group is $1415, multiplied by 0.06 gives $84.90 as the amount of the fixed charges. Proceeding in the same way we find the rent, power and administration. The amount of the tools and sundry expenses was entered from Form 3 where they were recorded after a detailed analysis of the item making up these headings. The total "machine expense" for the group is shown to be $1,683.40 and for one machine $420.85.

Data are usually collected for some time before it is possible to determine the average hours of operation. When they are known all that is necessary is to divide the yearly expense by the average hours which gives in the case under consideration $0.16 per hour.

In case a factory maintains its own store rooms expense incurred in connection with material is disposed of as a burden on material and, therefore, does not affect the "machine expense" account.

By using machine hour rates for the distribution of factory expenses as a burden on labor and material rates for the distribution of expense as a burden on material very accurate costs can be arrived at.

Depreciation	$27,483
Insurance	575
Taxes	3,472
Total	$31,530
Face value of machinery	$525,500
Ratio	0.06

CHART 1. FIXED CHARGES.

Charges incurred in connection with the grounds, buildings, fixtures, heating, cooling water, house telephone, passenger elevators and illuminating system.

Depreciation	$15,000
Insurance	500
Taxes	4,000
Changes	2,092
Repairs	6,350
Wages, sweepers and cleaners	7,005
Watchmen	3,500
Elevator operators, passenger	500
House telephone operator	600
Ushers in hall	200
Supplies, cleaning	1,500
Telephone	650
Light	8,500
Steam power	1,450
Unclassified	203
Total	$51,960
Available area in square feet	103,920
Ratio	0.50

CHART 2. RENT CHARGES.

Charges incurred in connecton with the line and jack shafting, motors, belting and current distributed.

Depreciation	$4.850
Insurance	20
Taxes	40
Changes	1,250
Belting	355
Oils	25
Waste	35
Repairs	475
Wages, motor cleaners	405
Wages, oilers line shafting	105
Administration	30
Rent	100
Electric current distributed	7,810
Total, electric current transmitted	$15,500
Kilowatt hours	281,818
Ratio	0.055

CHART 3. ELECTRIC CURRENT TRANSMITTED CHARGES.

Salaries, superintendent	$3,600
Salaries, foremen	25,005
Salaries, foremen's clerks	9,010
Salaries, shop cost department	3,005
Stationery	2,035
Changes to shop fixtures	300
Errors	150
Depreciation of shop fixtures	900
Taxes	50
Injuries	500
Insurance	150
Repairs	955
Unclassified	40
Total administration	$45,700
Number of productive operators	914
Ratio	$50

CHART 4. ADMINISTRATION CHARGES.

Belting	$735
Changes to small tools	10,100
Changes to shop fixtures	2,005
Depreciation of small tools and depreciation of shop fixtures	35,200
Insurance on small tool and insurance on shop fixtures	210
Repairs	8,110
Salaries, machine oilers	1,200
Salaries, setting up machines	2,000
Setting up new machinehy	785
Stationery	35
Taxes on small tools and fixtures	275
Transfer of machinery	500
Waste	723
Rent	800
Unclassified	175
Total charges	$62,853

CHART 5. TOOL CHARGES.

Changes to shop fixtures	$475
Chemicals	300
Defective work	950
Depreciation of shop fixtures	4,255
Fuels	223
Gas	822
Hauling shop rubbish	275
Insurance on supplies	25
Miscellaneous	210
Oils	5,000
Repairs to shop fixtures	975
Stationery	200
Taxes	50
Salaries	2,000
Water	100
Administration	25
Rent	350
Total sundry charges	$16,235

CHART 6. SUNDRY CHARGES.

Grinding Locomotive Crank Pins

Editorial Correspondence

The accompanying illustrations show two special grinding machines used in sequence to grind the several bearings upon locomotive wheel sets. They are products of the German grinding machinery builder Friedrich Schmaltz, at Offenbach on Main.

The first of these, Fig. 1, is designed for grinding axle journals and also inside crank journals, such as are found on European types of locomotives. By this machine the main journals are finished round, parallel and properly centered with respect to the axle and the crank pins are gaged at correct angles as well. The wheel set is then taken to the machine shown in Figs. 2 to 6, which grinds the outside crank pins for the driving and connecting side rods, and the return-crank pins for the Walschaert valve gear, an attachment being provided for internal grinding also if required.

Grinding Internal Cranks

The former machine will not be described in detail further than to say that the grinding mechanism is held by a two-part annular housing wherein is a ring, also diametrically divided, carrying a plate with the grinding wheels on either the right or left side as desired. The two abrasive wheels, mounted on the same arbor, are driven by belts and gearing, there being a toothed crown inside the housing. The upper part of the housing and the inner ring are removed to mount the work. The provisions for adjusting and testing the work are para-

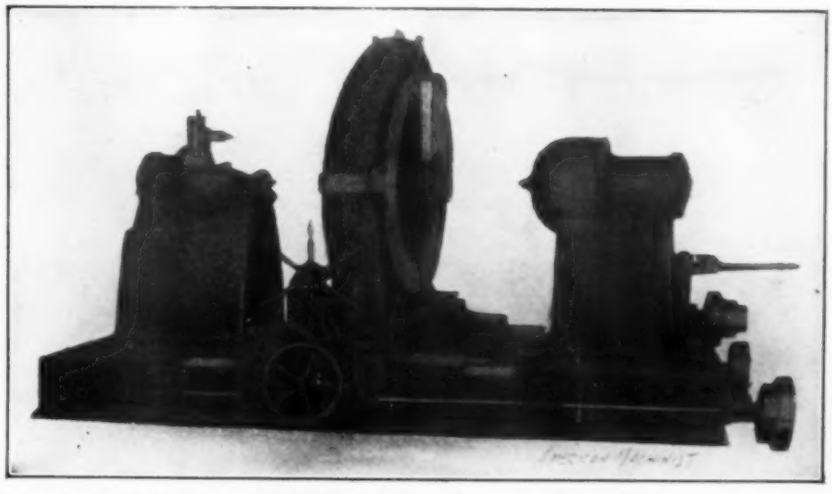


Fig. 1. Machine for Grinding Inside Main and Crank Journals of Locomotive Wheel Sets

mount features of this machine as of the one next to be described.

Grinding External Cranks

Referring to Figs. 2 to 6, the axle is mounted on the V-blocks of the central fixture. The grinding mechanism is at the right, while at the left is a three-point gage for testing with precision the angles and positions of the cranks, as well as for chucking the work.

The grinding mechanism executes a motion of revolution about the work. It has also an axial movement, controlled automatically or otherwise. The revolving head consists of a cross arm *v*, Fig. 4, carrying on radial guides a knee which holds the head proper, *h*, with its wheel. The cross arm is automatically balanced by counterweight *m*. The radial adjustment of head *h* on arm *v* can be made while the machine is in motion, by differential gearing; the coarse adjustment being performed by hand wheel *k* and the

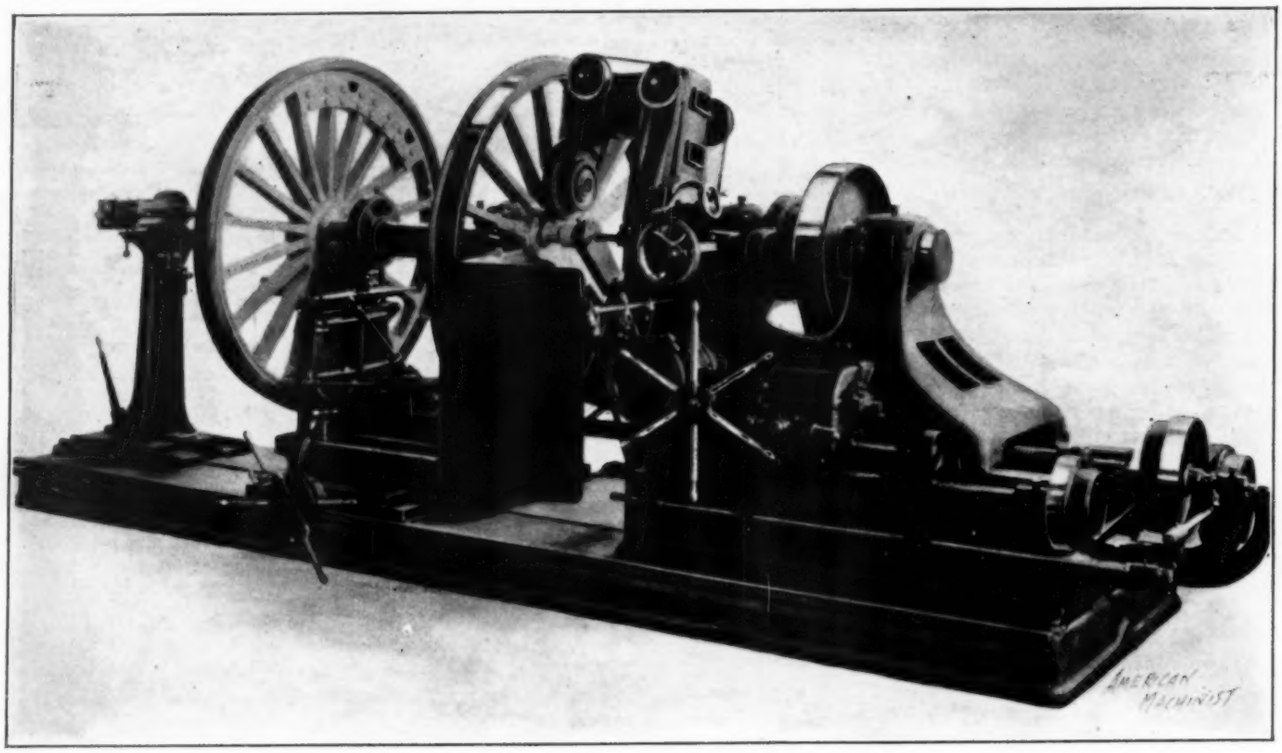


Fig. 2. Machine for Grinding Outside Crank Pins

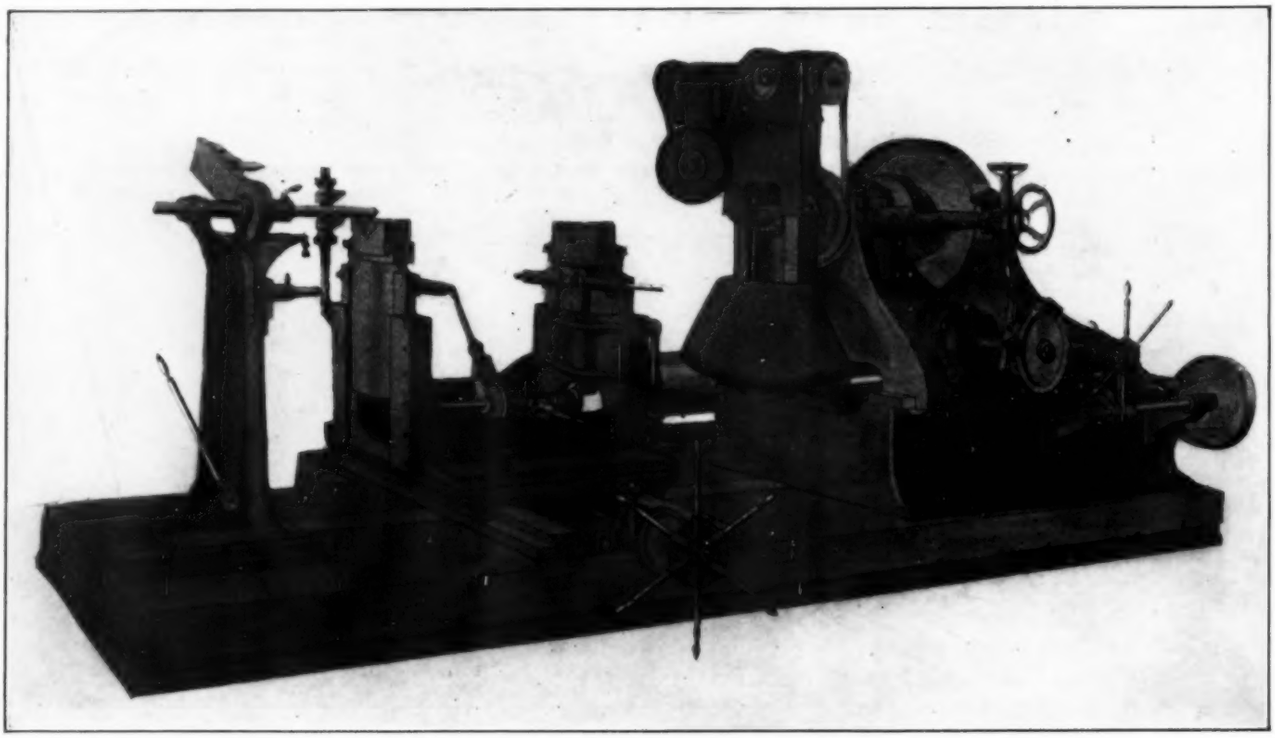


Fig. 3. Another View of the Outside Crank Pin Grinding Machine

fine one by hand wheel *l*. The head *h* is slightly adjustable obliquely in the plane of the axis to allow for grinding fillets. In broad bearings it carries an easily interchangeable abrasive wheel 14x4 inches, facing either way and covered by a cast-steel hood.

The frame for chucking the wheel sets has a cross movement by hand, actuated by pilot wheel *o* and fine-adjusted by scale *r*, and a vernier graduated to 1/10 mm. This fixture has also a swiveling movement about a horizontal axis, in order to reverse the wheel set end for end. This swivel movement may, however, be eliminated and the wheel set be turned in the V-blocks.

The two supports of the wheel have in common a coarse, vertical movement by ratchet *n*, shown more plainly in Fig. 3, while each singly has a precise cross adjustment *p*, and a vertical one p_1. The wheels are kept from turning by a clamp *q* on one of the spokes.

The three-point gaging fixture *t*, placed opposite the grinding head, serves to test the wheel sets in respect to the positions and angles of the crank pins and return cranks, according to the working drawings, if this has not already been done on the machine shown in Fig. 1. In any case, its main center s', which stands axially opposite to the center *s* of the grinding mechanism, is important for testing the horizontal and vertical positions of the wheel set. Further, to insure an accurate horizontal position, a differential spirit level is provided.

The centering of the work may, at first glance, seem a little confusing, especially because in the elevation, Fig. 4, the crank which is being ground appears co-axial with the axle of the wheel set, but it goes without saying, that the center of revolution of the grinder *s* is alined with the center of the crank pin that is to be ground. If the main axle be centered upon *s*, it is only for purposes of adjustment or testing and, before grinding, the fixture holding the wheel set must be shifted across to bring the crank pin into position.

For purposes of safety, beside the hood over the grinding wheel, screens are placed before and behind the grinding head, the one in front constituting a door whose opening stops the revolving mechanism.

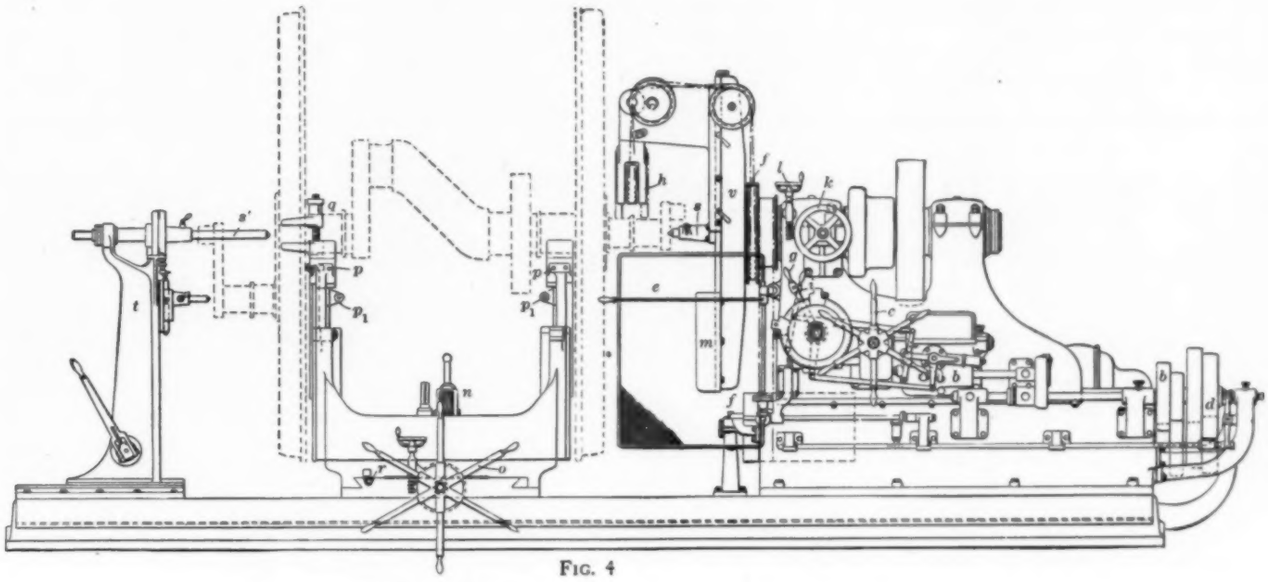


FIG. 4

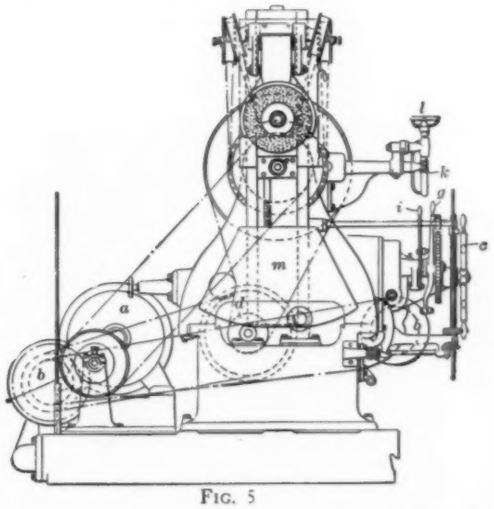


FIG. 5

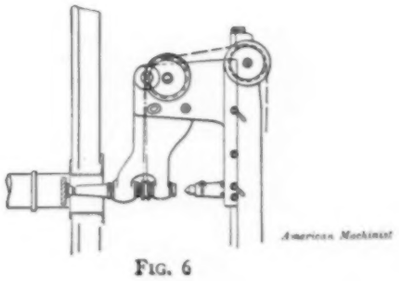


FIG. 6

ELEVATIONS OF THE GRINDING MACHINE

THE OPERATION OF THE MACHINE

The machine is operated as follows: The wheel set is mounted by means of a hoist and its axle centered. If the inner journals have in every respect been correctly ground on the machine shown in Fig. 1, and if their supports are exactly adjusted, the position of the axle can be determined without further trouble, and it is then necessary only to adjust the precise center of the crank pin upon the center of the revolving head *v*. In case these centers do not quite agree, correc-

tion is easily made with the help of the accompanying three-point gaging fixture.

When the crank pins on one side are ground, the wheel set alone or with its swiveling carrier is turned around 180 degrees.

A further test for the inner journals on the axle relative to its outer centers, and an accurate adjustment for journals unequal in diameter, can be made with the differential spirit level.

Internal grinding of crank-pin holes may be performed with the interchangeable head shown in Fig. 6 and exact parallelism with the shaft be secured.

The machine is driven by the 10-horsepower motor *a*, Fig. 5, though belt drive may be used instead.

In addition to the reference letters already cited on the drawings, are the following, which may be identified to throw further light on the various movements: At *b* is the drive and reverse for the axial automatic motion of the headstock; *c* provides the axial movement of the headstock by a pilot wheel; *d* is the drive of the revolving motion; *e* is the lever for stopping the revolution; *f* is the belt running over guide pulleys to drive the grinding wheel; *j* is a lever controlling the automatic motion of the headstock; *i* is a lever for stopping the headstock.

The builders have planned a layout for the two machines by which one workman can operate both from a single standpoint. A traveling crane is placed to serve them expeditiously, and the grinder dust is removed by a system of suction conduits with water-spray nozzles.

Operations in a Shaper Shop

By G. K. Atkinson *

A method of milling the slot in an important shaper member by means of a simple fixture and a special form of cutter arbor.

Means adopted for protecting the finished heads of shaper rams to prevent them from becoming bruised and burred in handling about the shop.

*Superintendent, John Steptoe Shaper Company.

For milling the slide of their shaper pendulum, the John Steptoe Shaper Company, Cincinnati, Ohio, uses the fixture shown in Fig. 2. After boring and reaming the holes *A B* in a jig and machining the radii *C*, the pendulum is mounted in the fixture shown on the milling-machine table, and lined up by means of the wedge block *D* and clamped as illustrated. The planing strips *E* are machined on all the castings in the lot with an end mill, after which the arbor carrying the roughing cutter and the adjustable cutter is inserted in the spindle and supported at its outer end by the overhanging arm. The pendulum is now located in line with the roughing cutter, there being a recess at *F* for a starting point, and a roughing cut taken off the top and bottom of the slide to within a few thousandths of the finished size, then the work is brought out in line with the adjustable cutter and finished. The adjustable cutter is a standard machine reamer backed off with proper clearance for milling, and makes a very satisfactory milling cutter for this class of work.

Protecting Heads of Shaper Rams

The protection of finished parts in the manufacture of shapers, is a very important feature, and in the shops of this company, a very simple and effective protection is used for the head of the ram.

These rams are shifted to different positions around the shop, and are usually stacked up at these different points, as shown in Fig. 1, and from the time the rams come from the lathe, a brass cap is placed over the head of each ram to prevent it from being marred.

Before these ram caps were used, it was found that occasionally one ram falling against another, would create a bur. After the harp was scraped in to the front of the ram, it had been customary to leave the rams in the machine after they had been scraped to a perfect bearing in the ways, and when the machines were being tested before being shipped, they were found to chatter. This usually meant a loss of time looking for the cause, and eventually it would be found that a bur had been formed by setting the rams against each other.

To overcome this difficulty, this brass cap was made and turned on the inside to fit the end of the ram. The ram caps are painted red, so that they cannot be left in any place without being noticed, and as soon as they are taken off the rams, they must be returned to the tool room. Different sizes of ram caps are made for the different sizes of machines, and they are lettered on the front to indicate to what size machine they belong.

Fig. 1. Caps for Protecting the Heads of Shaper Rams

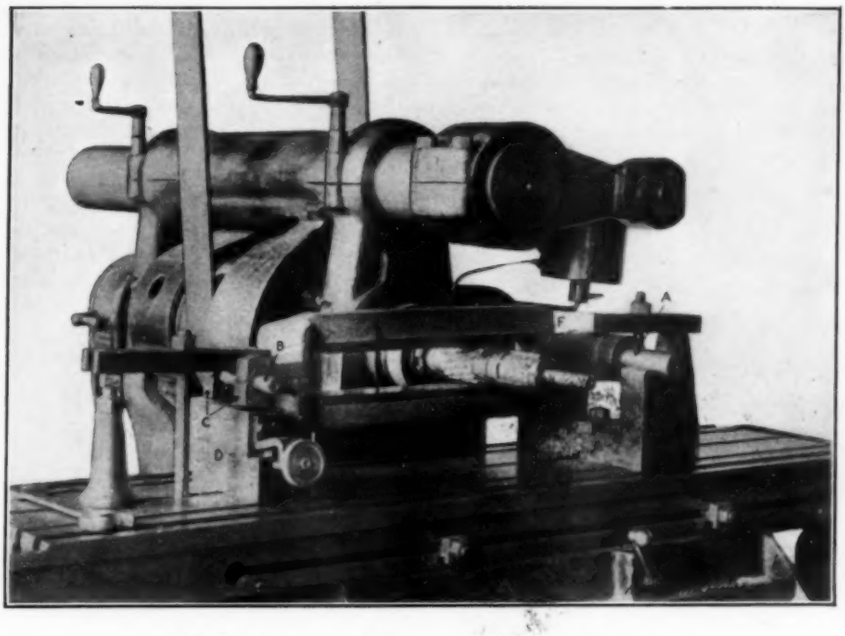


FIG. 2. MILLING THE SLIDE OF A SHAPER PENDULUM

This avoids any possible confusion, as it prevents the machinist from taking out of the tool room a ram cap that does not belong to the ram which he desires to cover.

A thumb screw is placed at the side, as shown, in order to enable the mechanic to fasten the caps to the rams, and remove them readily.

The development of the blowpipe in connection with various processes of welding and cutting steels placed in the hands of the "dark-lantern fraternity" a powerful weapon for prying into safes, and the use of manganese to defy it has correspondingly increased in safe construction. Manganese steel is not absolutely noncuttable by the blowpipe if the latter can obtain a starting point, which is avoided in the round forms of safes now coming into wide use. From a report abroad a new material, a patent application for which has been filed covering its employment in the construction of safes, has been discovered and successfully experimented with. It is mentioned that the material is manufactured in an electric oven at a much higher temperature than it is possible to operate any blowpipe now in use, and an experiment with a safe-door section built up of two sheets of half-inch steel, with a layer of this resisting material between, showed that it was absolutely nondrillable and a positive resistance to the cutting powers of the blowpipe.

Gages Used in Testing Materials

By H. F. Moore*

Ames dial gages are extensively used in the laboratory of the University of Illinois to test large specimens of materials of construction. These tests include those for tension, compression, deflection and fiber strain, on wood, steel, concrete and terra cotta. An interesting method is in use to calibrate the gages.

*Assistant professor of applied mechanics, University of Illinois.

The laboratory of applied mechanics of the University of Illinois in conducting tests of materials, especially in tests of large specimens, have often had to measure small strains over various parts of the specimen under test. In many cases the number of strains to be measured was large, and the number of measuring instruments required was consequently large so that expensive instruments were out of the question. In many cases the measuring instruments had to be attached to pieces so irregular in shape or so bulky that the usual type of extensometer, which

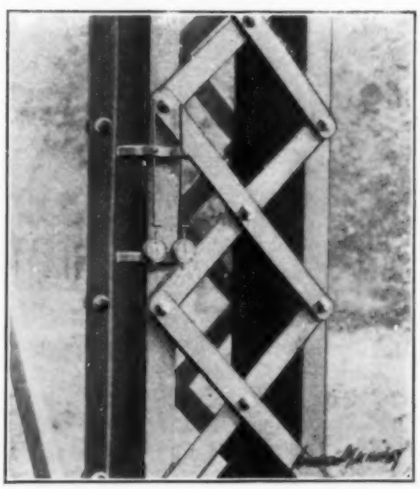


FIG. 2. TESTING COMPRESSION IN FLANGE OF RAILROAD BRIDGE PART

is designed for attachment to small tension test pieces, could not be adapted to the test. Some comparatively inexpensive measuring instrument which could be readily attached to large and irregular specimens, and which was capable of indicating with reasonable accuracy strains as small as one ten-thousandth of an inch was needed. At the University of Illinois one form of machinist's test gage has been found to fulfill the above requirements.

The particular test gage used at Illinois is the one manufactured by B. C. Ames & Co., of Waltham, Mass. This gage is about the size of a watch, and the amount of strain is indicated by the motion of a plunger, this plunger motion being magnified by clockwork so that on a dial a rotating hand indicates plunger motion to the nearest one one-thousandth of an inch directly, and to the nearest one ten-thousandth of an inch by

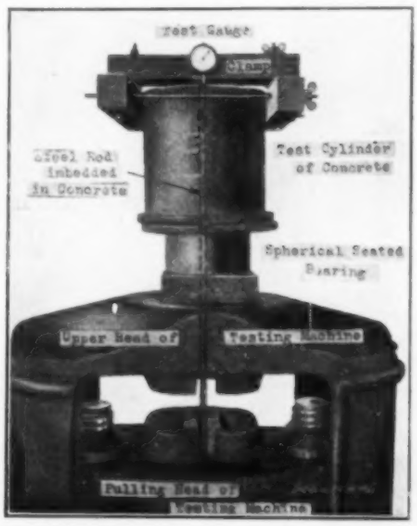


FIG. 3. TESTING SLIP OF A STEEL ROD EMBEDDED IN CONCRETE

estimation. On the back of the gage is a projecting lug by means of which the gage may readily be fastened to any clamping device for attachment to a test specimen.

Used as an Extensometer on a Steel Specimen

Fig. 1 shows a pair of test gages used as an extensometer in a tension test of a steel specimen. The gages are mounted on a brass clamping frame which grips the specimen between round edged V surfaces on one side and a sharp edge on the other. A similar upper clamp carries rods which bear against the plungers of the gages. As the specimen stretches the rods move away from the gage plungers and the plungers "follow up" the ends of the rods. The average of the gage readings gives the stretch of the test piece. There must be considerable spring to the clamps of this apparatus, or very shortly after the yield point of the specimen is reached, and the specimen begins to grow noticeably smaller in diameter, the clamps will become loose. This apparatus has proved convenient in operation and very fairly accurate in comparison with more expensive types of extensometers.

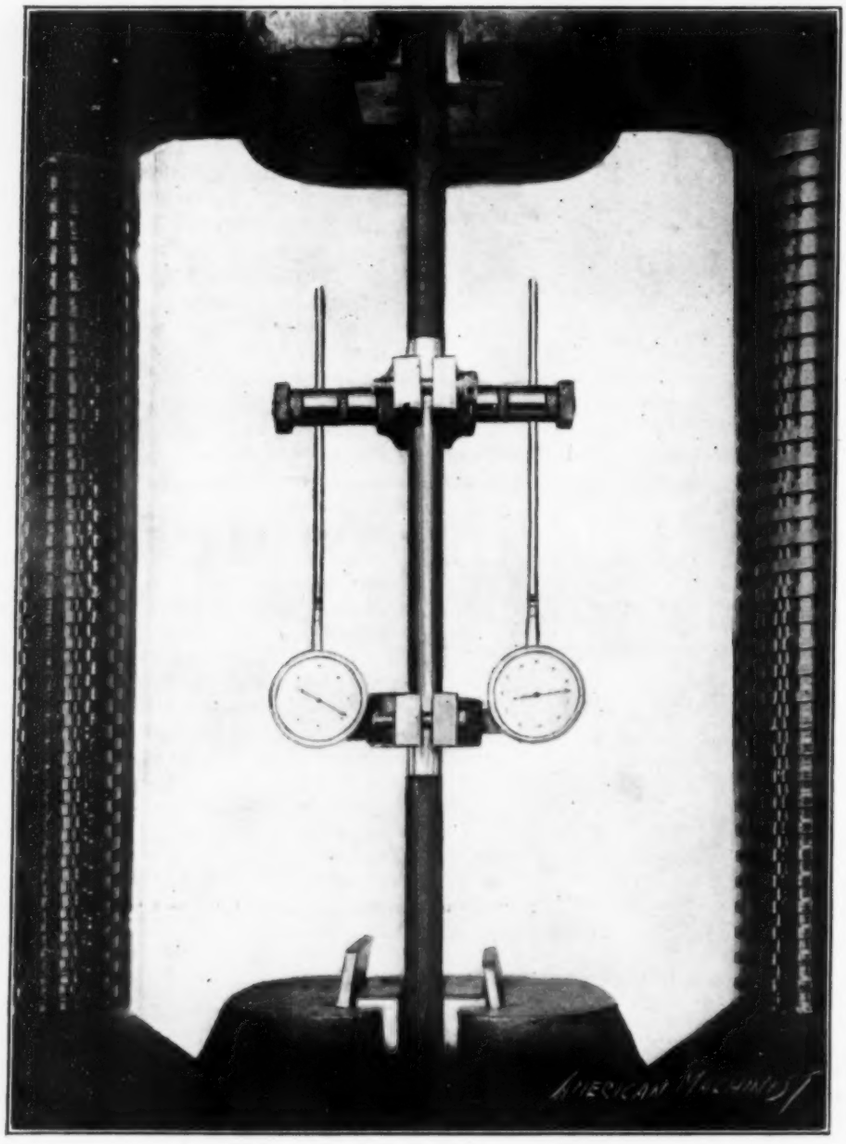


Fig. 1. Ames Dial Gages Used as an Extensometer

Used to Determine Compression

Fig. 2 shows a pair of test gages used to determine the compression in a short length of the flange of a post in a railroad bridge in actual service. The clamps used here were cast-iron U clamps with point bearings. This simple arrangement showed very plainly the great variation in strain which exists in different parts of a loaded built-up steel column.

Used to Measure Slip of a Steel Rod in Concrete

Fig. 3 shows a test gage used to measure the slip under load of a steel rod imbedded in a test cylinder of concrete. The test cylinder is placed resting on a spherical-seated bearing, which, in turn, rests on the upper head of a testing machine. The steel rod whose adhesion is to be tested extends clear through the test cylinder of concrete, projecting slightly at the top, and extending below a sufficient distance to be gripped in the pulling head of the testing machine. The test gage is fastened to the concrete cylinder by means of a wooden clamp, and the plunger of the test gage bears against the upper end of the steel rod. As the rod slips in the concrete cylinder the amount of slip is shown by the reading of the gage.

Used to Measure Fiber Strain in a Concrete Slab

Fig. 4 shows an arrangement of a number of test gages to measure the fiber strain in various parts of a reinforced concrete slab. The slab is shown loaded at eight points by means of a hydraulic jack and a system of load-distributing beams. In the slab were cast numerous pieces of steel rod *S S S S*, each of which projects about two inches above and below the slab. To measure the strain between any two of these pieces of steel rod, uprights *U U* of angle-iron were clamped to the pieces in question. A rod *R* carrying a test gage clamped to it was fastened to one of these uprights, and this rod rested on a rounded surface of the other upright. The plunger of the test gage bore against a flat side of the second upright. As the distance between the two pieces of steel changed the strain was shown (magnified) by the test gage. The cut shows only the top side of the slab; for every gage used on the top of the slab, a corresponding gage was used on the bottom of the slab, so that the strain in both top and bottom fibers was determined. In Fig. 4 gages are shown in place to measure the strain between several pairs of rods.

Other Uses

The Ames test gages have been used at the University of Illinois for many other tests than the ones described above, among other tests may be mentioned: Deflection of timber and of steel beams; spread of hooks under load, compression of wooden blocks; compression of brick and of terra-cotta columns. In cases in which the direction of strain can be predicted, it has been found better to arrange the dial so that under strain the plunger of the instrument shall be pushed in. However, the instrument works fairly well when the plunger moves out as strain increases. In the arrangements shown in Figs. 1 and 3 the plunger moves out as strain increases, while in Figs. 2 and 4 the plunger is pushed in under increasing strain.

In laboratory work in materials testing it is usually essential that the strain-measuring apparatus used shall show very

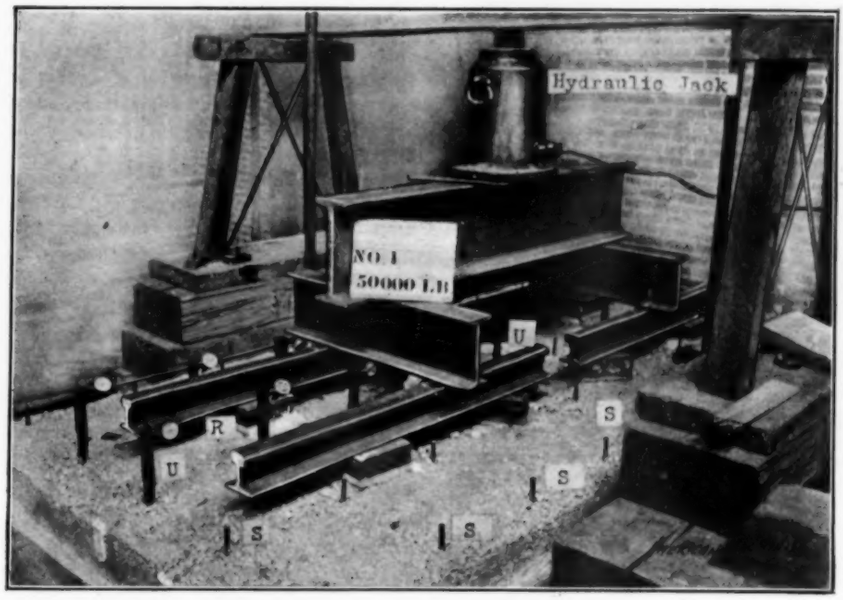


FIG. 4. TESTING FIBER STRAIN IN A CONCRETE SLAB

small changes of dimension of test piece with reasonable accuracy, and it is of relatively less importance that measurements of larger motions shall be made with extreme accuracy. The Ames gages used at the University of Illinois read directly to one one-thousandth of an inch, but ten-thousandths of an inch may readily be estimated on the dial. To test the accuracy of measurement of very small strains a Brown & Sharpe micrometer reading to one ten-thousandth of an inch was placed under the "long" end of a 10 to 1 lever and an Ames dial placed at the one-tenth point. The micrometer was moved slightly, the test gage read by estimation to the nearest ten-thousandth inch and the micrometer read. The difference between one-tenth the micrometer reading and the gage reading was taken as the error of the gage. Another reading was then taken, and the process repeated until a range of about one one-hundredth of an inch motion of gage had been covered. In a test of six Ames gages by the above method the average deviation between micrometer determination and gage reading was nine one-hundred-thousandths of an inch. The greatest observed deviation was three ten-thousandths of an inch. These errors included the personal error in estimating tenths of a division on the gage dial.

Worm and Gear Hobbing Attachment

By M. E. Hoag

A special attachment applied to an Acme automatic screw machine, for hobbing worms and spiral gears, built by Warner Auto Meter Company.

Production of 560 pieces per day as against 100 per day on a single-spindle special automatic, previously built for the purpose.

In the manufacture of Auto Meters, Cut Meters, and other similar instruments put out by the Warner Instrument Company, of Beloit, Wis., there are used a large number of small worms and spiral gears, which of necessity must be produced rapidly, and at small cost.

The usual process of first cutting the stock in a thread miller, and then finishing in a hand-screw machine, produced good work, but was found too slow and expensive. A single-spindle screw machine with a gear-hobbing attachment, built especially for the Warner Instrument Company, gave work of excellent quality, but the output was small, so that in the end they were forced to design an attachment that could be applied to an Acme automatic screw machine. The result of their endeavors is clearly shown in the accompanying halftones.

Fig. 1, taken from the back of the machine, shows the cutter *H*, driving worm *F*, and worm gear *C* The head *A* is fitted with a double slide, gibbed to allow longitudinal motion as the cutter is advanced or withdrawn by the tool turret of the screw machine, while the cross slide *D* permits adjustment of the cutter and worm gear to work of different diameters.

Spindle *B* has ball-thrust bearings, hardened shaft and bushings, and adjustment for raising or lowering the cutting edge of the cutter. Arm *G* is bolted to the turret and to the slide in the head *A*, and serves to traverse the cutter along the worm and the piece operated upon. It also carries a bronze bushing for the worm shaft *E*, which extends to the end of the machine, where it is connected to the drive by gears that give the correct speed to the cutter.

As the speed of the spindles and cutter are always constant, the turret may be advanced or withdrawn, rapidly or slowly, and the cutting of the worm or gear will always be correct, provided the gear and worm ratios are right, and the pitch diameters of the worm gear *C* and the cutter *H* are the same.

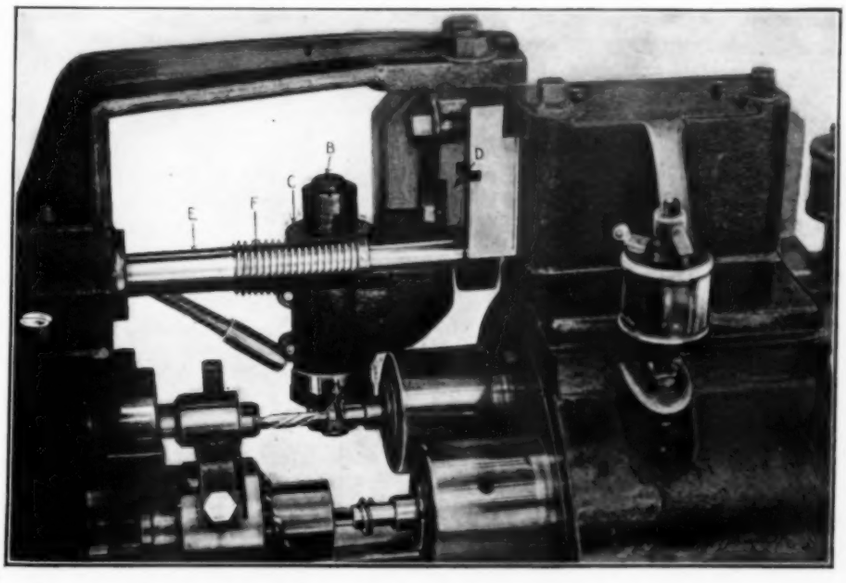


FIG. 1. REAR VIEW OF SPECIAL HOBBING ATTACHMENT

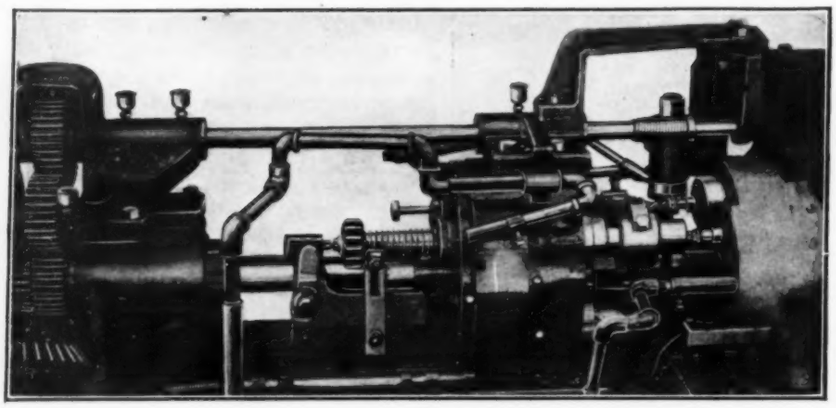


FIG. 2. GENERAL VIEW OF MECHANISM

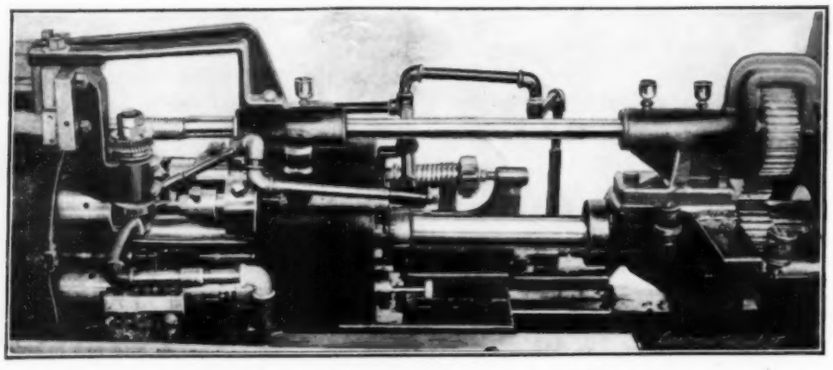


FIG. 3. FRONT VIEW SHOWING CUTTER AND WORM WHEEL

Fig. 3 is taken from the front of the machine, and gives a better idea of the construction of the attachment.

Worm *F* is of machinery steel, case-hardened, keyed to the worm shaft, and held in place by a collar, seen in Fig. 1, which allows it to be easily replaced by others as may be needed for different jobs. The worm gear *C* is of bronze, and the cutter of Bohler H. S. steel.

By the other methods used, the thread miller cuts enough stock for 250 gears in a day, and one man running a hand screw machine, forms, drills, and reams about 500 gears a day from the screw stock. The single-spindle automatic produces 100 finished gears per day, while the new attachment on the Acme automatic produces 560 per day and requires no more attention than for ordinary work. This output could be increased by speeding up a little and sharpening the cutter oftener, but at the rate of 560 pieces per day it was found necessary to sharpen it but once for about every 5000 pieces.

The tree, which is abundant in Central China from which Chinese lacquer is obtained, grows wild and is cultivated at altitudes of 3000 to 7500 feet, the owners of the land claiming the varnish produced by it. The tree is tapped in June or early July, and the exuding grayish-white juice collected in shells bamboo tubes, etc., and protected from oxidation by being covered with oiled paper. The tapping is repeated seven times at intervals of about seven days, and the tree is then left from 5 to 7 years to recover. In addition to that used locally, large quantities of the varnish are exported, principally to Japan. Adulteration of the varnish with tung-oil is of frequent occurrence. In 1908, 2,479,972 pounds of the varnish at a value of about $725,000 were exported.—*Brass World.*

Some Trick Jobs on the Automatic

By S. H. Bacon

There are many unique pieces made on automatic screw machines besides those seen in machine exhibits, these *fancy* pieces are always made on the automatics to save expense, as six machines can be run by one operator, and another reason is to finish the piece on one machine. Fig. 1 shows a small piece made on a ⅜-inch Cleveland automatic screw machine.

The previous method of making this piece was to cut off on the milling machine and twist in a fixture made specially for the purpose. The piece was changed to the automatic machine because the desired product was unattainable with the twisting fixture. The piece was held in a rectangular chuck, which was keyed to the spindle so as not to turn when it was twisting. After the stock was fed out, the turret came forward with the tool, the end of which is shown in Fig. 2. Just before the stock enters the rectangular hole (shown at *a*), the spindle is stopped by a pin protruding from the chuck cap coming in contact with a block on the front tool post. This method of stopping the spindle has been described before in an article on cross drilling.

The spindle is now released by the front tool post dropping back; this allows it to twist the stock, the end of it being held in the tool, Fig. 2. When the stock has been twisted correctly, the spindle has made a quarter turn, when it is again stopped by the block on the front tool post. It is necessary to provide a special cam to bring the front slide forward twice as the back slide is used for the cutoff tool. After the turret has withdrawn the spindle is released the second time and the piece cut off. This piece is made from soft iron, and the time for one piece is 12 seconds, or a gross product of 3000 in 10 hours.

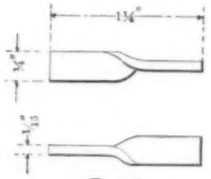


FIG. 1

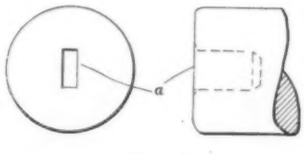


FIG. 2

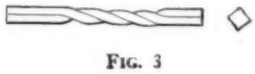


FIG. 3

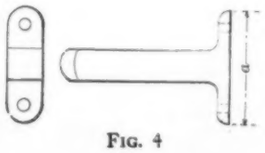


FIG. 4

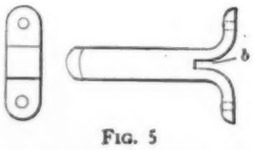


FIG. 5

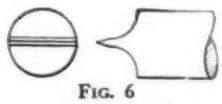


FIG. 6

TRICK JOBS ON THE AUTOMATIC SCREW MACHINE

The approximate order of operations is as follows:

	No. of Rev. at 1200 Rev. per Minute.
Feed stock to stop	30
Revolve turret	30
Stop spindle	20
Take hold of piece	30
Release spindle and twist	20
Stop spindle	20
Release spindle while turret withdraws	20
Cut off	70
Total for one piece	240

The square piece shown in Fig. 3 is similar to the one just described, but as it is made on a No. 00 B. & S. automatic screw machine with a special set of cams. The job is easy to set up and gives very little trouble, the production obtained on the automatic screw machine was 6000 pieces in 10 hours, while the old product was 2500 in 10 hours, the work being done with a fixture.

The time for one piece is six seconds, and the maximum surface speed of stock is about 83 feet per minute. The spindle is stopped the same as for the piece just described, and the special tool for twisting has a square hole. The time allowed for revolving the turret is a trifle over one-half second, which is sufficient, that is, running at 1800 revolutions per minute would equal 15 revolutions per one-half second, while we have allowed 16.

In Fig. 4 is seen a small standard as it was made on the milling machines. This piece was milled from rectangular bar stock, the holes were then drilled in the drilling department. It is now made on the No. 0 B. & S. automatic screw machine, as shown in Fig. 5. The slot at *b* is cut with a saw held in the turret as described in the AMERICAN MACHINIST in a previous issue. After the slot is sawed, the special tool, Fig. 6, comes forward and spreads and shapes the feet. The widths of these feet represented by *a*, Fig. 4, were of various dimensions. This caused setting up on the milling machine for each width and the use of various sizes of stock on the screw machine. However, it was only necessary to saw a little deeper for the wide feet.

Another saving on this piece is in drilling the hole on the screw machines, thus doing away with the drill-press operation. These holes, or rather one hole, is drilled through the stock with the cross-slide drilling attachment, and after the end is split this hole becomes two holes. The rounded ends are another saving, as they are formed by the cutoff tool instead of being done in an extra operation, as was necessary when the piece was made on the milling machine.

In figuring up the amount of material saved on a lot of 5500 pieces, I find that for a piece 1½ inches long there is a difference of 116¾ pounds between the ¼x½-inch stock used on the milling machine and the ¼x¼-inch stock, which is used on the screw machine.

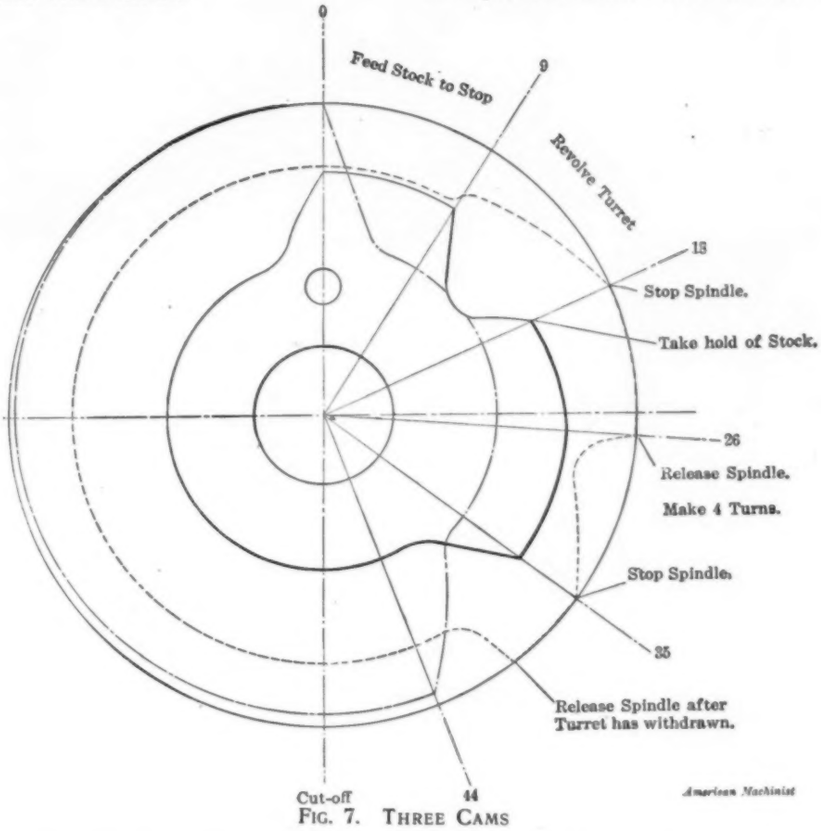


FIG. 7. THREE CAMS

	1800 Revolutions per Minute.	Hundredths of Cam Surface.
Feed stock to stop	16	9
Revolve turret	16	9
Stop spindle and take hold of piece	14	8
Release spindle, make 4 revolutions and stop spindle	17	9
Withdraw turret and release spindle	16	9
Cut off 0.110 inch travel at 0.0011 inch feed	101	56
Revolve turret 4 times while cutting off	65	36
Total number of revolutions to make one piece	180	100

ORDER OF OPERATIONS.

	998 Revolutions per Minute.	Hundredths of Cam Surface.
Feed stock to stop	44	3
Cut off 0.197 inch travel at 0.002 inch feed	104	7
Revolve turret 4 times	176	12
Stop spindle and drill 0.310 inch throw at 0.001 inch feed equals 310 revolutions at 2400 R. P. M. or	133	9
Clearance	37	2½
Saw slot 0.500 inch throw at 0.070 inch feed 125 revolutions of saw at 122 R. P. M.	1023	69
Revolve turret	37	2½
Spread and form end	67	4½
Revolve turret	37	2½
Total number of revolutions for one piece	1482	100

Gross product in 10 hours—400 and the time for one piece—90 seconds.

ORDER OF OPERATIONS.

Fig. 7 shows three cams, each shown by a different kind of line. It will be noticed that the back-slide cam, shown by dots, is not cut to the bottom. This is because the block on the back slide is not required to back away very far. The lead or turret-operating cam is shown by a full line.

The spindle is reversed just before the pin in the chuck cap comes in contact with the block on the cross slide; this is to lessen the force of the blow.

Baseball Mathematics

Baseballs have been caught when dropped from the top of the Washington monument, by at least two well known league players. The distance dropped is 542 feet, and by the time the ball reached the catcher's hands, its velocity is calculated to have been about 180 feet per second, or over 120 miles per hour.

If the pitcher could throw a 9-ounce ball with such strength that it would reach the top of this monument, assuming that his hand is propelling the ball through a distance of 5 feet before letting go, he would have to exert a constant pressure of about 60 pounds upon the ball until it left his hand.

If the catcher, in receiving the dropped ball, allowed his hands to move down a distance of 2 feet, the average stopping force which he exerted must have been nearly 150 pounds. The probabilities are that his hands stung somewhat after the performance.

Methods Used in Building Lathes

By F. A. Stanley

Processes and tools employed in milling, planing and drilling headstocks, footstocks and aprons for engine lathes.

Details of jigs and fixtures employed for holding the work, and cutting tools for performing the various operations.

A few points relating to the scraping and testing of heads, carriages and tailstocks.

The accompanying engravings illustrate some of the tools and methods used by the Willard Machine and Tool Company, Cincinnati, Ohio, in the manufacture of engine lathes.

Milling Headstocks

The first operation in machining the headstock consists in milling the seats for the caps, and is accomplished by the fixture shown in Figs. 1 and 2. In this fixture the rough casting rests upon two fixed supports and two adjustable ones, which are operated by plugs with wedge-shaped ends, adjusted by set screws to support the casting firmly under the lower edge. Details of the adjusting plugs with the swiveling caps upon which the work rests, are shown in the drawing, Fig. 2.

As will be noticed, the headstock casting thrusts against a stop pin at the right-hand end, is forced back against stops at the rear by a swinging strap and screw in front, and is held down by straps at the top at either end. A gang of inserted-tooth milling cutters is used and the work table is adjusted to bring the headstock in correct position laterally under the cutters by a hardened-steel setting gage, attached to the upright at the right-hand end of the fixture, the gage being a duplicate in section of the seat which is to be milled for the cap.

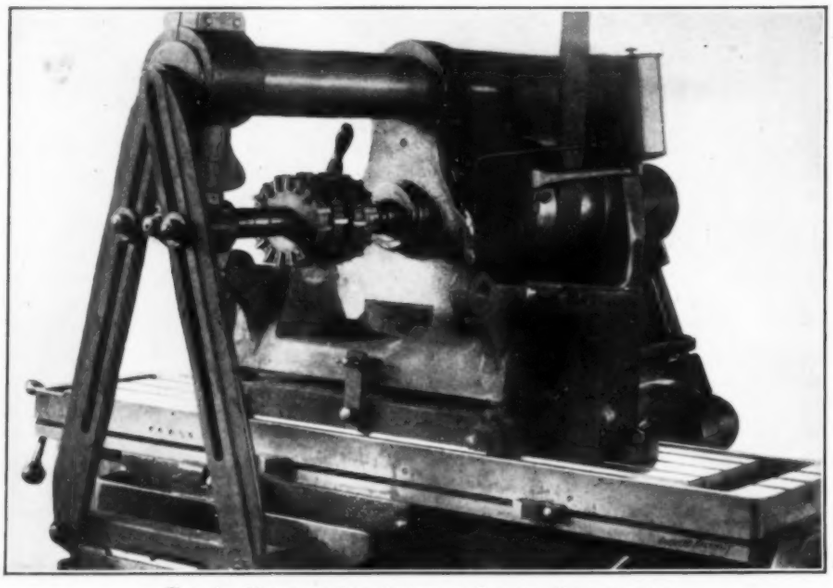


Fig. 1. Milling Cap Seats in Lathe Headstocks

Planing the Bottoms of Headstocks

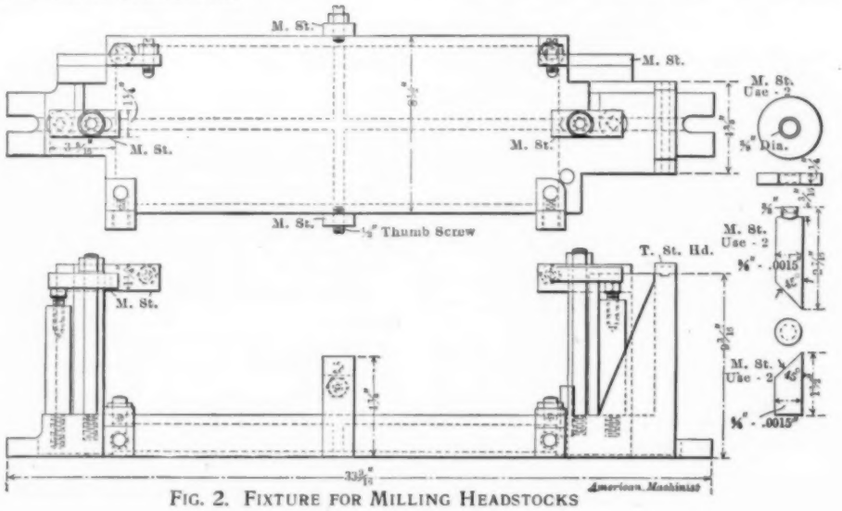
Following the milling of the cap seats, the headstocks are placed as in Fig. 3, bottom side up in two rows upon long fixtures on the planer platen, for the machining of the surfaces, which fit the ways on the lathe bed. There is one V and one flat bearing surface for the head, and tools are shown in the planer for finishing the V's in the two rows of headstock. The fixtures in this case are long castings, with ribs upon their upper surfaces over which the cap seats in the headstocks fit nicely, so that they line up correctly with the fixtures for the planing operation. Steel pins are inserted at the required points to take the thrust of the work under the action of the cut and simple straps are applied at each end of the headstock to hold them down. The tools are readily set to master blocks or gages, shown at the further end of the rows of castings.

A Boring Operation

After the caps have been drilled and put in place and the head drilled from the bottom and tapped for the holding bolts, the headstock is placed in the fixture, Fig. 4, which is used under a radial drill for the boring operation.

First, the casting is bored for the brasses, which form the boxes, and for the steel bushings, which receive the back-gear shaft. At the same setting the ends of the head uprights are counter-bored from each surface to receive the flanges formed on the brass boxes. As illustrated, the boring bar is guided in bushings at each end of the work and carries two cutters, which operate simultaneously at both ends of the casting. One set of cutters is used for roughing, then finishing cutters are applied for the second cut. The counter-boring cutters are so spaced as to machine the corresponding faces at both ends simultaneously. For counter-boring the back faces at each end the fixture is swiveled through a half circle, bringing the lower end to the top and the counter-boring cutters applied again.

It should be noted that the counter-bored seat at the left end of the headstock is used as a locating surface, from which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the pad for the quadrant seat is afterward milled to correct hight. This seat in turn constitutes the locating point for the tumbler shaft.

The Swiveling Fixture

Fig. 5 represents the head-boring fixture swiveled through an angle to illustrate more clearly its construction and operation. It has at the right-hand upper corner a locking pin, which indexes the swiveling member in a vertical position when swung either end up. Swing bolts attached at the four corners form convenient means of clamping the pivoted member to the upright support. The whole affair is readily mounted on the drill-press base and bolted to the side of the table, and the I-bolt at the top permits the fixture to be picked up by the chain hoist for removing or setting in place.

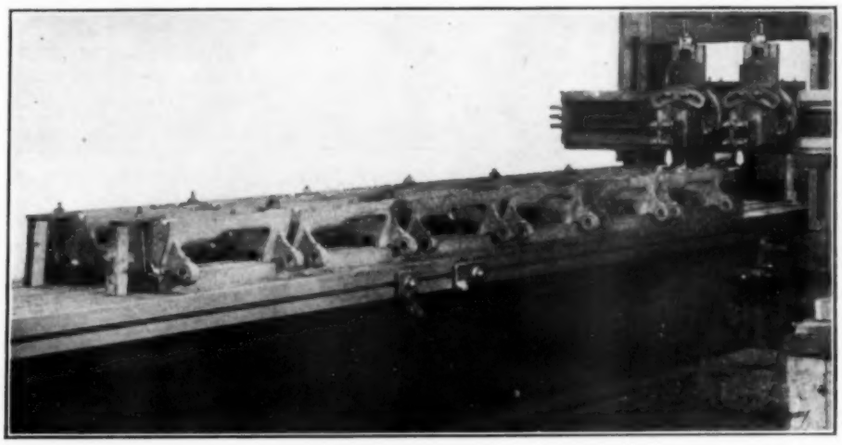


Fig. 3. Planing Bottom of Lathe Headstocks

The Boring Tools

The boring bars used in this fixture are driven from the spindle by universal joints, as represented in the illustration. Complete sets of bars, cutters, bushings and reamers are shown in their case to the left of the drilling machine.

The brass boxes for the spindle bearings are first rough bored in the lathe and turned to diameter; they are then put in place in the headstock and the latter put back in the nxture shown in Figs. 4 and 5, for the boring cuts to be taken through the boxes, the second cut removing about 1/64 inch of metal, then a finish cut of about 0.003 inch is taken. This leaves the bearing surfaces very smooth and the scraping operation in the boxes during the erecting of the lathe consists in merely "touching up" the already nicely finished surface.

The cutters in the various boring operations are all double ended and are made of high-speed steel. They are round in section, are made accurately to size and are centered by a conical point entering a corresponding seat in the middle of the cutter. When not in use the cutters are safely kept in sheet-metal clips attached to the tool case as represented in the halftones.

Tailstock Bases

Figs. 6 and 7 illustrate two operations in machining tailstock bases. First, the castings are milled on the bottom as in Fig. 6, with gang cutters, then the top surface is planed, roughing and finishing cuts being taken, after which the work is turned over again, and on the fixtures seen in Fig. 7, the bottom-bearing surfaces are finished by planing. The method of resting on tissue paper, the means of clamping, and the setting of the tool to a master or templet at the end of the work, are all plainly shown. The tool is made to the proper angle and the head is fed down straight.

Referring again briefly to the operation illustrated by Fig. 6, it should be pointed out that the fixtures are of the duplex type; that is, while one casting is undergoing the milling process, another casting is placed in the other fixture so that it in turn may be milled while the first piece is being removed. This enables the work to be handled easily and economically. The milling fixtures have three fixed supports for the under side of the casting, while the fourth support under the remaining corner is adjustable by means of wedge-shaped plugs, as used in the fixture, Fig. 2. The thumb screws which press the work against stops at

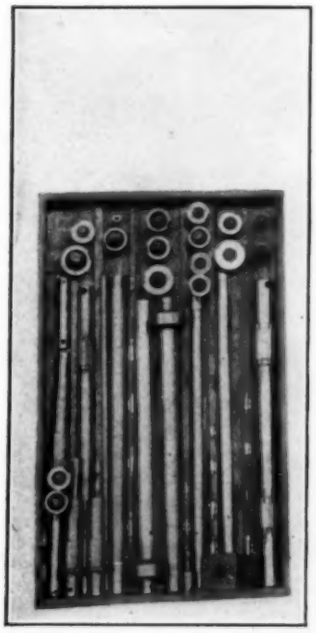
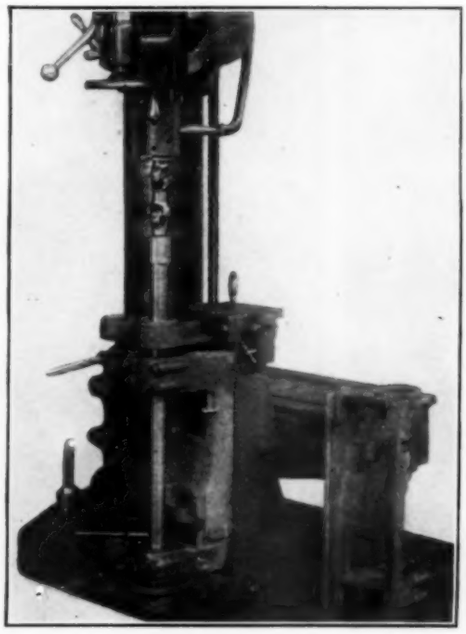


Fig. 4.



Fixture and Tools for Boring Headstocks under the Radial Drill

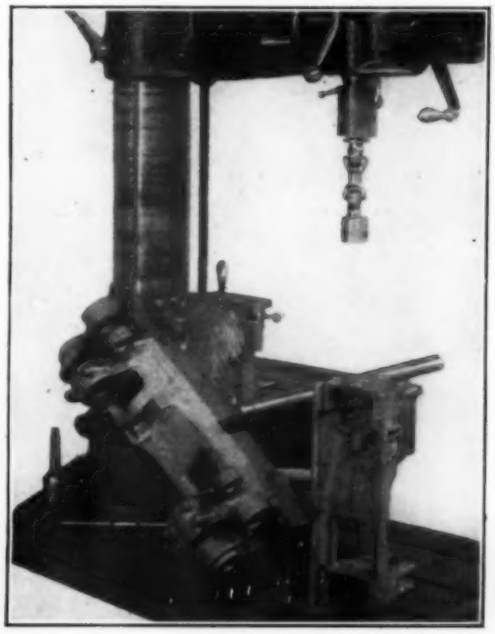


Fig. 5

the back and the holding-down straps at either end, are clearly seen in the illustration.

The tailstock proper is assembled on its base after it has been planed on the bottom, and the slot has been cut for the spindle clamp. When the guides underneath the base have been scraped to a master, the assembled tailstock is placed in a boring fixture similar to the one used for the headstock. Here with the tailstock clamped against ways corresponding to the top of the lathe bed, the hole for the spindle is bored under the radial drill. The slot for the clamp is, of course, fitted with a strip of metal preparatory to the boring of the spindle opening.

A Drill Jig for Aprons

In Fig. 8 is illustrated a set of tools that represent an outlay of several hundred dollars. The jig is used for drilling and boring the numerous holes in lathe aprons, and it is provided with a very complete set of drills, reamers, counterbores, and other cutting tools, as well as with the necessary equipment of changeable bushings for guiding these tools.

This drill jig has at *A*, *B* and *C*, three hardened supporting points for the rough casting. At *D* there is a spring-actuated telescopic bushing to receive tapered boss *E* on the front of the apron, and at *F* and *G* are two bevel-edge, hardened-steel locating shoes, which contact with the sides of bosses *H* and *I*. Now, when a casting is placed in the jig, and hub *E* enters spring bushing *D*, the latter is depressed until the apron casting comes to rest upon the three hardened supports, *A*, *B*, *C*. At the same time, while centered in the jig by the locating bushing *D*, it is positioned by the bearing taken on the sides of bosses *H* and *I* by hardened stops *F* and *G*.

The three straps which hold the work in the jig when swung back into position are guided by dowel pins, so that the ends of the straps bear upon the work at points directly opposite the supporting hardened plugs upon which the apron rests.

The positions of the various bushings, the supporting edges of the jig, also the location of the holes for bearings, screws,

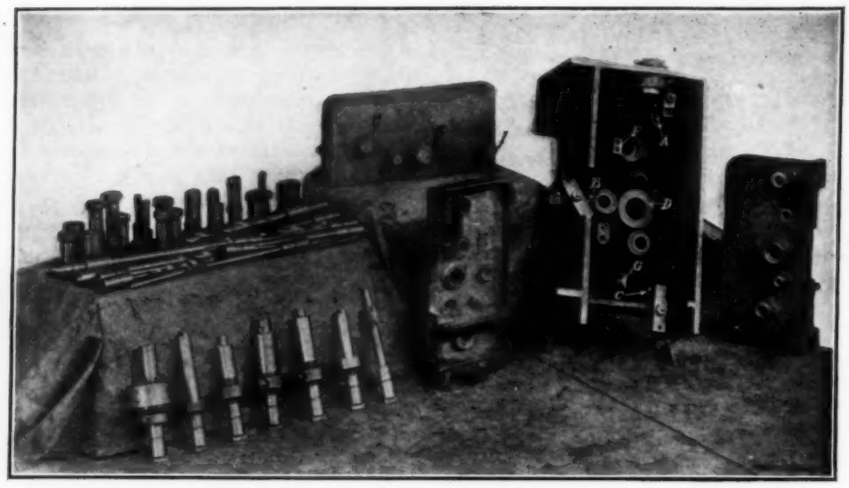


Fig. 8. Apron Drilling Jigs and Tools

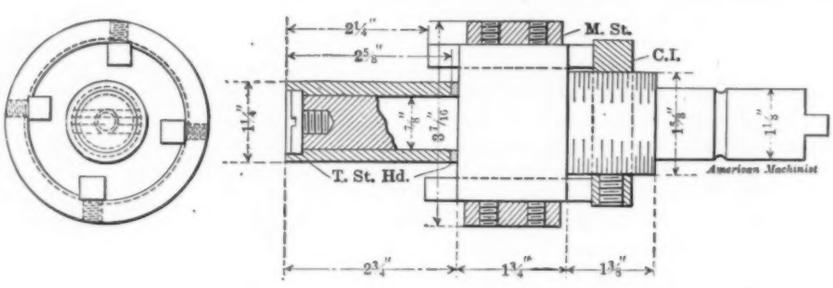


Fig. 9. Facing and Turning Tool for Apron Work

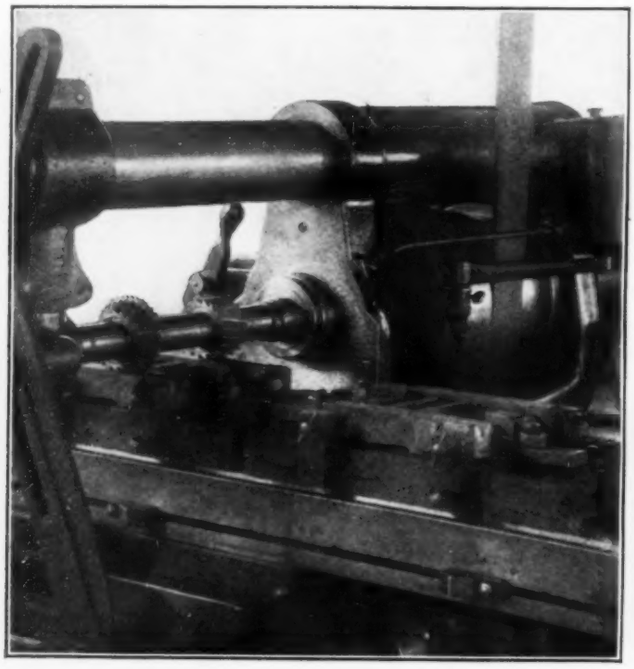


Fig. 6. Milling Tailstock Bases

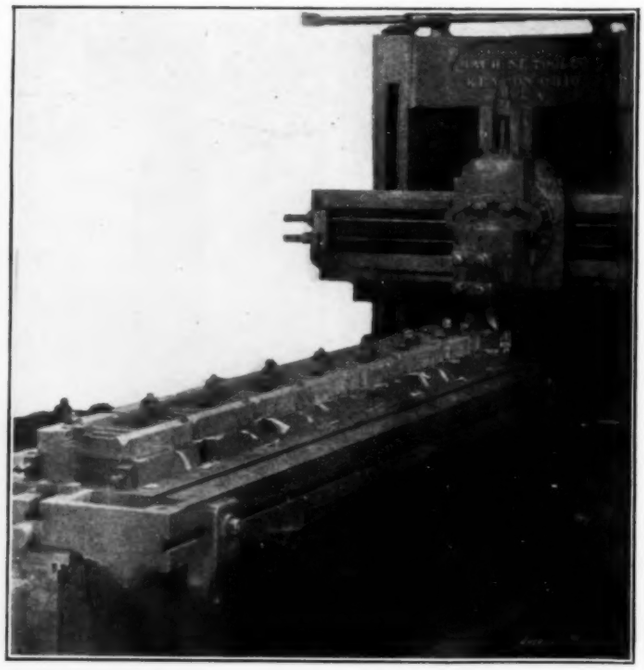


Fig. 7. Planing Tailstock Bases

etc., in the apron itself are brought out clearly by the illustration.

Drill-jig Tools

Among the group of tools to the left there are some interesting facing and hollow-milling appliances, and one of these is shown in detail in Fig. 9. This tool is employed for turning off the outside of one of the bosses in the apron and at the same time squaring down a shoulder to form a bearing for one of the running members. The cutters, of which there are four, are inserted in grooves in the body of the tool, forced to the bottom of said grooves by screws in the ring around said body, and backed up by a threaded collar by which they are adjusted as required.

The lower end of the tool has a revolving pilot, which fits a hole already bored in the apron, and the bottom end of the pilot also serves as a stop for depth upon coming in contact with a corresponding stop in the fixture.

Milling Aprons

The fixture in Figs. 10 and 11 is used for milling aprons. In one case it is shown placed upright against an angle plate on the table of the miller, and in the other is placed flat on its own base. In the first instance, Fig. 10, the apron is shown mounted squarely on suitable locating plugs, in position for the milling of various bosses and pads inside, and is illustrated with a cutter in operation, milling the vertical slots for the half nut.

A series of hardened setting plugs or gage points for the cutters will be noticed at the end of the fixture, and every surface milled in this device has a corresponding locating stop to which the cutter is set for obtaining at once the correct location of the milled surface.

Fig. 11 shows how the top of the apron is milled to fit the under side of the carriage. After the face mill has been passed across the work, giving a straight surface, a cut is taken, starting a few inches from one end and running to within the same distance of the other, removing, say, 1/32 inch of metal, thus forming a clearance so that the apron will bear firmly against the carriage at each end.

It will be recalled that in the drill jig, shown in Fig. 8, the work rests upon three hardened supporting points. In the milling fixture, in Figs. 10 and 11, there are three similar supports located exactly the same distance apart as in the jig, and contacting with the apron casting at the very points upon which it rested for drilling. Similarly all of the clamps which hold the apron and the milling fixture take a bearing immediately opposite the supporting member.

Erecting and Testing

In erecting and fitting up the lathe it is first carefully leveled upon adjustable shoes placed under each leg, a precision level being employed upon the shears. The ways are cross scraped merely to remove the loose metal. The headstock and footstock are scraped to a master block representing a section of the bed to which block another block has been scraped, which is used in cross scraping the ways of the bed.

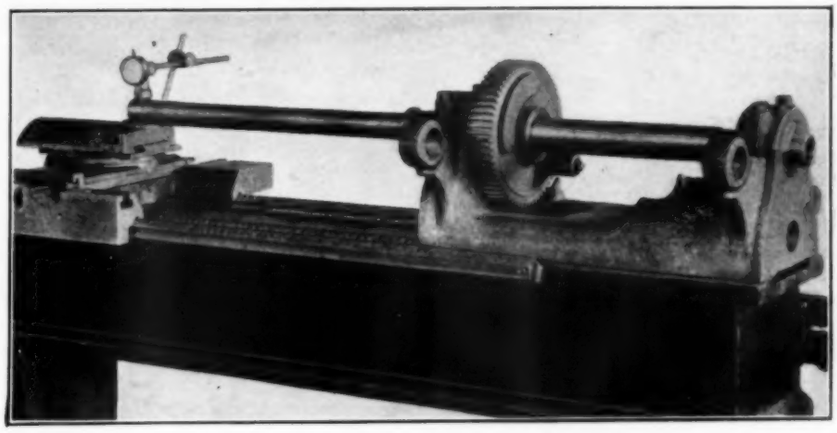


Fig. 12. Testing Spindle Alinement

A method of testing the head alinement is shown by Fig.12. A hollow test bar 24 inches long is used for this purpose and a dial gage is applied at the top at both ends of the bar in testing the alinement vertically, and is also used at the front of the bar on the center line in making the side alinement test. During the test the bar is turned to various positions and the test should show the bar to be high at the outer end 0.001 inch, and the bar should also run 0.001 inch toward the front at the outer end.

In testing the footstock, its spindle is removed, and a test bar which projects 12 inches is put into the tailstock in place of the spindle. The indicator is then applied to this test bar for parallel-

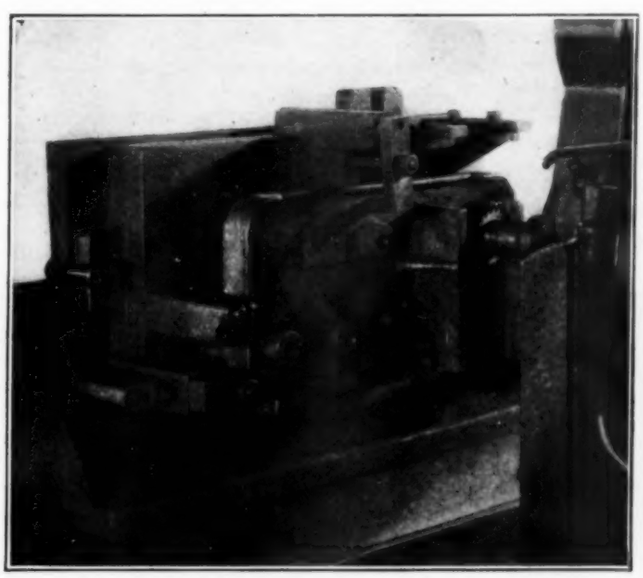


Fig. 10

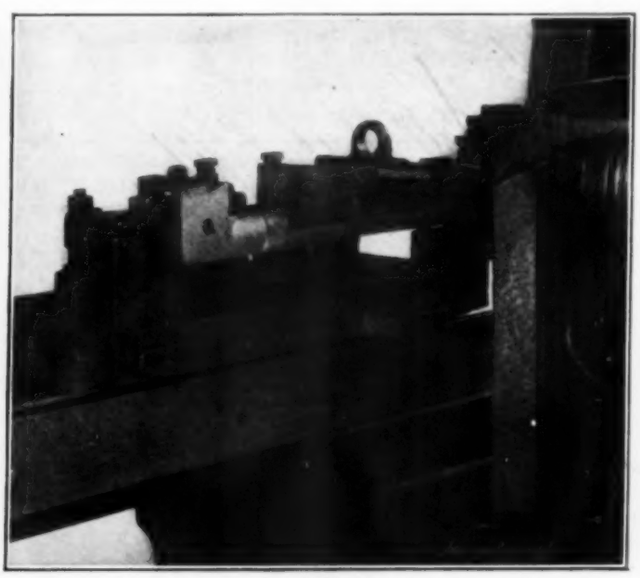


Fig. 11

Milling Lathe Aprons

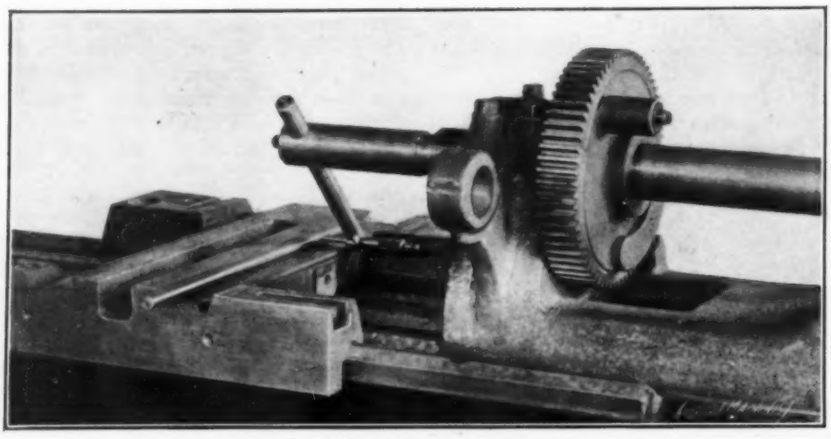


FIG. 13. TESTING CARRIAGE

ism, and this method, of course, tests the alinement of the tailstock with the spindle either in or out.

USING THE MICROMETER IN TESTING

Fig. 13 shows an interesting application of the micrometer head for facilitating the operation of scraping the carriage, so that the cross-slide guide shall be square with the spindle. A bar is placed in the spindle, carrying an adjustable arm, in the outer end of which is placed a micrometer head. A rod ground truly parallel is placed in the angle of the dovetail guide to form a contact or testing surface for the end of the micrometer spindle. The lathe spindle is rotated to bring the micrometer head first to the front and then to the rear end of the test rod, thus determining the amount the carriage is out of square, and as the scraping is proceeded with the error is gradually eliminated, until finally, when the carriage has been scraped to the proper bearing on the shears, it has also been brought with the cross slide square with the spindle. This micrometer appliance is a simple device which works out efficiently in practice, and by modifications it has numerous applications.

Machining Crank Cases and Cylinders

Editorial Correspondence

Data as to speeds and feeds in milling crank cases and boring cylinders, compiled from information furnished by some of the leading shops regarding their own practice.

An even casual inspection of the speed and feed used in any line of machine-shop work is sure to show wide discrepancies, but these are sometimes more apparent than real.

The automobile industry has done much toward the introduction of higher speed, and in order to show what has actually been accomplished in this line, we have secured data from a number of the leading shops, showing their practice in both milling and boring.

Bearing in mind that all of the milling, excepting that from shop No. 6, is in aluminum, this gives a very fair idea of what may be done with this metal.

Roughing speeds vary from 68 to 853 feet per minute, while for finishing 837 feet is the maximum, although 400, 500, 700 and 800 are also used. Finishing cuts are very light, but in roughing the feed seems to be very heavy at times, considering the speed. We have heard of milling feeds up to 31 inches per minute, but 20 inches seems to be the highest used in any of these cases. Considering the material used by No. 6, the results obtained seem to be very good indeed.

Shop.	Kind and Size of Cutter.	Revolutions per Minute, Roughing.	Cutting Speed, Roughing.	Feed per Revolution, Rough'g.	Feed per Minute, Roughing.	Depth of Cut, Roughing.	Revolutions per Minute, Finish.	Cutting Speed, Finish.	Speed per Revolution, Finish.	Feed per Minute, Finish.	Depth of Cut, Finish.
1	10″ H. S. Inserted Tooth	26	68′	0.108	2.8″	$\frac{5}{16}$″	26	68′	0.298′	7.75″	
2	14″ " " "	40	146	0.25	10.	$\frac{1}{2}$″	40	146	0.5	20.	$\frac{1}{64}$″
3	14″ " " "	100	366	0.125	12.5	$\frac{5}{32}$″	100	366	0.125	12.5	
4	12″ " " "	100	300	0.03	3.	$\frac{1}{8}$″	120	400	0.15	6.	
5	H. S. Porcupine Cutter; 10$\frac{1}{4}$″ head; 8 cut'rs, $\frac{1}{4}$″ sq.	174	520	0.046	8.	$\frac{3}{32}$″	174	520	0.046	8.	0.008″
6*	5″ H. S. Inserted Tooth	104	136	0.057	6	$\frac{1}{8}$″	104	136	0.04	4	
7	12″ " "	65	200	0.1	6.125	$\frac{1}{4}$″	230	700	0.055	12.5	
8	15″ " "	20	80	0.1	2.	$\frac{5}{16}$″	50	200	0.041	2.25	
9	15″ " "	112	450	0.156	17.	approx. $\frac{3}{16}$″	200	800	0.1	20.	$\frac{1}{64}$″
10	16″ " "	200	853	0.078	16.	$\frac{5}{32}$″	196	837	0.078	15.	0.025″

*No. 6. This is a manganese-bronze crank case; the rest are aluminum.

TABLE NO. 1. MILLING AUTOMOBILE ENGINE CRANK CASES.

Shop.	Bore.	Stroke.	How Many Cuts.	Speed of Roughing per Minute.	Feed of Roughing per Rev.	Speed of Finishing per Minute.	Feed of Finishi'g.	Average Boring Time.	Allowance for Grinding.
1	4$\frac{1}{2}$″	4$\frac{1}{2}$″	2	35′ to 40′	$\frac{1}{16}$″ to $\frac{1}{8}$″	35 to 40′	$\frac{1}{4}$″p'r rev.	20 min.	0.006″
2	4$\frac{1}{2}$″	5″	2	29′	$\frac{1}{8}$″	29′	$\frac{1}{4}$″ " "	15 min.	0.015
3	4$\frac{1}{2}$″	5″	3	48′	$\frac{1}{16}$″	50′	$\frac{1}{16}$″	12 min.	0.0125
4	5″	6″	2	80′	..	100′	.....	.....	0.010
5	4″	4″	3*	46′	$\frac{1}{16}$″	36′	$\frac{1}{16}$″	.....	0.005or.01
6	4$\frac{1}{2}$″	4$\frac{1}{2}$″	2	40′	$\frac{1}{16}$″	40′	$\frac{1}{16}$″	14 min.	0.012
7	5″	5″	2	40′	$\frac{1}{16}$″	40′	$\frac{1}{16}$″	60 min.‡	.003
8	4$\frac{1}{2}$″	5$\frac{1}{2}$″	2	22′	$\frac{1}{16}$″	22′	$\frac{1}{16}$″	.....	.004
9	4$\frac{1}{2}$″	10$\frac{1}{2}$″†	3	40′	$\frac{1}{8}$″	40′	$\frac{1}{8}$″	33 min. per pair.	0.010

* Two cuts on lathe—one cut on vertical boring mill.
† Length of cylinder bore = stroke + piston length.
‡ Includes boring and grinding.

TABLE NO. 2. BORING AUTOMOBILE ENGINE CYLINDERS.

In the boring of cylinders the practice seems to be much more uniform with 22 feet as the lowest, and 100 feet as the highest cutting speeds. The grinding allowance has considerable variation considering the small amount of material to be removed. Average practice leaves about 0.01 inch for grinding, and the allowance of 0.003 inch in No. 7 is extremely small. This must require exceptionally accurate boring in order to have

the grinder clean out the hole perfectly true.

In calculating the time required, it is necessary to allow for the total length of the bored surface, which is usually about twice the engine stroke, and to consider the number of boring bars at work at the same time.

In the cases where the average boring time is omitted, the information was not clear enough to make sure whether it referred to a single cylinder or to two or four cylinders bored in the same casting at different times. The uniform average of the time given per cylinder made such figures as "3 hours," reported in some cases, indicate clearly that entirely different conditions prevailed in such cases.

We believe these data give average automobile-shop conditions, and except for the fact that the milling is nearly all aluminum, that they should be of assistance to the general machine shop.

Trade Conditions in Japan

By Charles A. Francis *

Though the United States has made rapid gains in her import trade with Japan, it would seem to the writer, if the manufacturers wished, that in the next 10 years a much larger showing could be made, particularly in view of the developments going on in the direction of increasing the facilities for motive power in that country.

The water power of Japan, of which there is a great amount, and which has been long neglected, is well adapted for the promotion of hydroelectric power, and the Japanese are now beginning to wake up to the possibilities, and the various enterprises now on foot indicate an enormous development in the use of water as power in the very near future.

The Tokyo Electric Light Company has already harnessed the forces of the Katsura river to the extent of something over 30,000 horsepower; while there are powerful syndicates comprising English and American capital being formed for similar enterprises on the Uji, Oi and Kinu rivers. Though one might say that some of the new schemes have not yet advanced beyond the investigation stage, it is believed that it will not be a very distant date before Japan will have at her disposal unrivalled facilities for the supply of cheap motive power, which is sure to have a very favorable effect on the industrial expansion of the country and anything that helps the expansion of Japan's industries should be the means of the expansion of the United States' import trade into that country.

If the American manufacturers are perfectly satisfied with the amount of trade they are at the present time receiving from Japan, and consider that they are getting their share (less than 20 per cent. total imports) therefore have nothing to "kick about" well and good. Should there, however, be those that nothing less than 99 per cent. of the trade in their line will satisfy, to these I wish to say that even taking into account the high and ever-increasing tariff tax on everything imported into Japan, also the present slowness of the money market, there is business to be had—if it is gone after in the right way.

Article.	Value of 1908 Imports.	Ratio against Total Imports. Per Cent.
Rails (steel)	$1,199,126	47.4
Electrical machinery	1,165,082	82
Pipes and tubing (steel)	935,879	60.5
Paper-making machinery	684,356	82.9
Locomotives	674,811	78.6
Lubricating oils	419,135	90.8
Railroad cars and supplies	378,017	52.8
Electric car parts	188,618	82
Sewing machines	144,354	80

TABLE OF SOME OF THE IMPORTS INTO JAPAN FROM UNITED STATES IN 1908.

*Industrial engineer, formerly conducting a practice in Tokyo, Japan.

The mistake has often been made by manufacturers in sending expensive salesmen to Japan, who, without any knowledge of the customs of the people or their language, have tried to talk trade direct with a proposed customer. To succeed in Japan as an agent, one cannot understand the customs of the people too well, nor the language; but even with this knowledge one cannot do any direct business as one would in America, but must have what is known in that country as a go-between.

Manufacturers should have their own direct representatives in the field, that they may derive the most satisfaction from the money they spend to get trade, not only in Japan, but in every part of the Orient.

Though they have placed their business in the hands of the most capable agents possible, a representative that knows every in and out of his company's goods, and who believes that the goods made by his company are the best for their various uses, can at all times look after his company's interests better than any agent who may be the agent for three or four other companies which make the same, or similar kind of goods.

A proper representative, if he keeps in close touch with the home office, as he should, can often be of great service to the company's agent, thus oftentimes saving the necessity of cabling for information at large expense. Another way he can be of great help to his company, and the company's agent, is by being at hand to instruct how a certain operation is done, or can be done. This is especially so in case of machinery such as screw machines or turret lathes with special tools and attachments. Another place where the representative should be of great service to his company is in a case where goods are broken or damaged *en route*. Frequently such damaged parts can be replaced in a much shorter time by having them made there, than to send them to the home factory, or if it is a case where a slight amount can be deducted from the bill, the quick action by the company's representative has the effect of not only pleasing the purchaser, but gives him to understand that the manufacturers can and will stand back of their goods, and by this treatment the manufacturers will have a much better chance of getting the order next to be placed.

The accompanying table shows that in 1908 the manufacturers of the United States furnished 82 per cent. of the total imports into Japan of electrical machinery. Now, on looking into this matter closely, one will find that this 82 per cent. was practically all exported from America, by two of its manufacturing companies. The reason for this is that both of these companies have their own representatives in the field, working hard with the help of their Japanese agents to keep the market. Each of these two companies follows a different selling system, and it is thought that if they would both adopt the same system it would result in the United States' share of total imports of electrical machinery soon reaching the 99 per cent. mark.

It will be difficult to find an English or German machine-tool builder that entirely entrusts his Japanese interests to his agent, Japanese or foreign. They usually have their own office, or in case a Japanese agent is appointed a direct representative is generally connected with the agent's office, paid by the manufacturer to see that their goods are properly placed before the buyers' notice.

If there is any good reason why makers of machine tools do not advertise in the daily newspapers of their own country and in the language of those that are expected to do the buying, there is a much better reason why these same makers of machine tools should discontinue their advertisements in the columns of English daily newspapers published in Japan or any other Oriental country.

There has been pointed out over and over again to manufacturers the necessity of having their advertising matter printed in the language of the people which they wish to interest in their goods, but after all that has been written on the subject, American manufacturers continue to send out hundreds of catalogs which are never read, thus throwing away good money.

A German Apprentice School

By Otto Stolzenberg*

The practice of Ludw. Loewe & Co. in combining apprenticeship with classroom school work.

In German industrial life it is recognized that one of the most important requisites for the flourishing of an enterprise is a capable staff of workingmen, the training of whom is one of the most important tasks of a manufacturing establishment which in this manner also renders an important social service. In view of the world-wide interest in this subject the methods followed by Ludwig Loewe & Co., who were pioneers in this field of work, can scarcely fail to be of interest.

*Superintendent of the training school which forms the subject of this article.

Selecting the Apprentices

At the start the most careful selection of apprentices is made. The total number of apprentices employed is about 120, about 20 new apprentices being taken on semi-annually. The number of applications is very large, as the factory is located in the workingmen's quarter of Berlin, and, because of the training given, apprenticeships are eagerly sought with the Loewe company. The 20 apprentices are selected from 30 applicants, who must first show that they have successfully attended the first class of an eight-grade municipal school—the first class in German terminology meaning the graduating class according to American usage.

Early in March and September the 30 applicants are summoned to the factory, where they are passed upon by the house surgeon and examined by the manager of the apprentice department. This examination comprises arithmetic, the writing of a short composition (the subject of the last composition was "Why Do I want to Become a Machine Builder"), the drawing of a few geometric figures, etc., all being intended to show whether the applicant has good perceptive faculties and is alert and smart; in a word, to show his intelligence. The factory managers of various departments are expected to be present during these examinations, occasionally asking questions themselves and in this manner 20 of the best students are chosen.

Fig. 1. A Class Room of Ludwig Loewe & Co.'s Apprentice School

The Trades Taught

The practical training of the apprentices is divided into six divisions, as follows:

First. Machine-construction apprentices.

Second. Machine-locksmithing* apprentices.

Third. Lathe apprentices.

Fourth. Planing and milling apprentices.

Fifth. Patternmaking apprentices.

Sixth. Molding apprentices.

The apprenticeship term of the first and

*The term locksmithing (Schlosserei) as used in Germany has little in common with the same word as used in English speaking countries. It appears to correspond more nearly with our terms vise work and fitting. The word locksmithing has, however, been retained in the translation.—Ed.

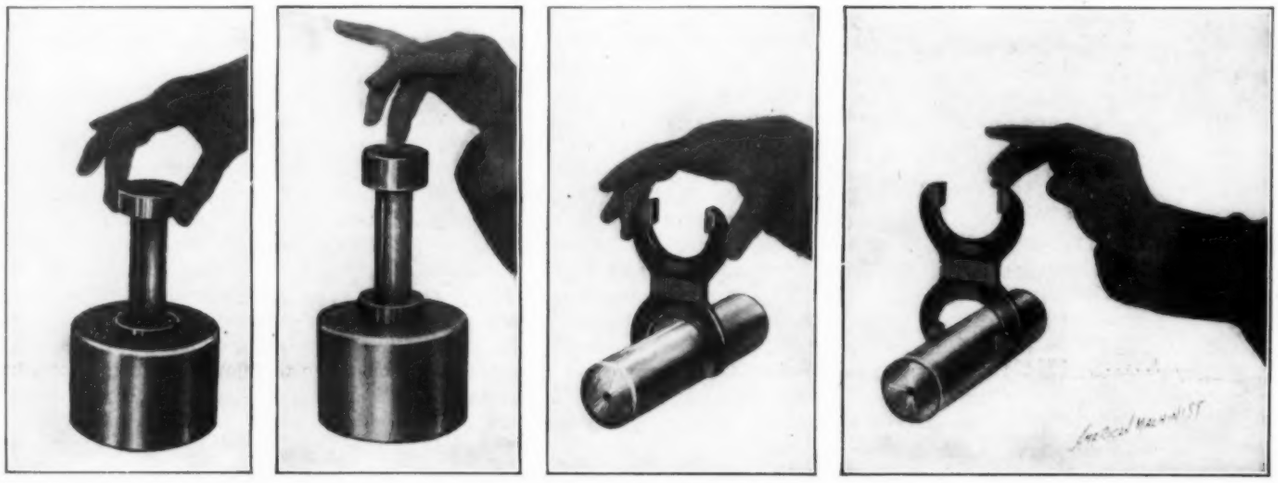


Fig. 2. The Magic Lantern in Shop-school Work. Teaching the Use of Limit Gages

last of these divisions covers a period of four years, and the remainder a period of three years, a year being understood to mean at least 270 working days. The trial term for all apprentices is three months. The apprentice is required to conform to the rules of the works and to become a member of the sickness beneficiary fund, his assessments for that fund being, however, paid by the firm. From the fund he is entitled to free medical treatment, including medicine. Such behavior is required as is appropriate to well behaved people. If need be a scholar can be expelled from the school, this being equivalent to discharge from the works.

The firm also takes one- and two-year volunteer apprentices, these being apprentices who intend to enter a technical college or high school and to become, later, engineers. They correspond to the English premium apprentices and are required to pay a tuition fee of 1000 marks for the first and 500 marks for the second year, the money being used to defray a portion of the expenses of the apprentice school. The regular apprentices pay no fee, but on the contrary receive regular wages.

Division of the Time

In the shop work the various classes of apprentices receive instruction in accordance with the accompanying table.

The figures of the table are to be understood as approximate only, the actual time spent on each class of work depending entirely on the gaining of a satisfactory degree of skill and knowledge. The work progresses from the easy to the difficult and is always under suitable supervision. Emphasis is laid upon the ability to utilize all of the work of the apprentices, who thus soon acquire the commercial spirit.

The German Apprenticeship Law

The German law is very strict in its provisions for the regulation of apprenticeship. The apprenticeship contract must be in writing, a trial period, which must last at least four weeks, but not exceed three months, being required. The apprentice must not be given work beyond his bodily strength, and there are various limitations regarding the hours of work and the provision of periods of rest. The employer likewise has responsibilities to the apprentice outside of shop hours, especially as regards his attendance upon continuation and trade schools.* These schools are, as a rule, maintained by the municipalities, attendance upon them being mostly obligatory, although there are many of a more advanced character upon which attendance is voluntary.

Apprentice Schools

Although these schools offer a wealth of good instruction, an apprentice school proper can be made still more effective—

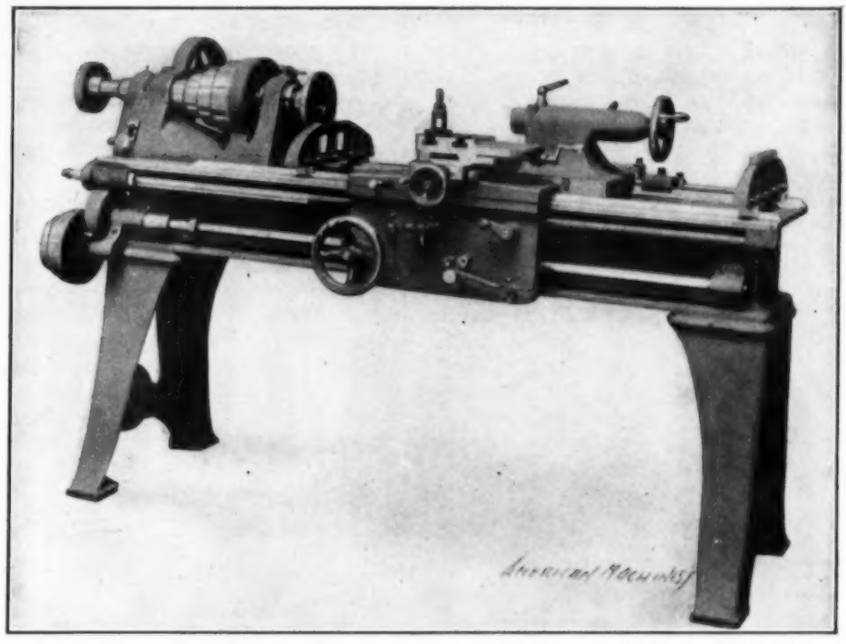


Fig. 3. The Use of the Precision Level Taught by the Aid of the Magic Lantern

attendance upon such schools which have received the necessary official certificate releasing the student from attendance upon the public schools. Among the advantages of an employers' apprentice school are the saving of much time in going to and from the school, and the releasing of employers from the supervising of apprentices outside of shop hours. With these advantages goes a consider-

*The word here translated as trade school is Fachschule, which is one of those words which in its translation has been the source of much misunderstanding. The nature of the school work described in the present article is the best possible illustration of the fact that in Germany this word means a school of an intellectual and not of a manual character. The plans described are, in fact, typically German, in that they comprise training in manual skill and dexterity under strictly apprenticeship conditions, along with intellectual work closely related to the shop work.

	Machine Constructors.	Machine Locksmiths.	Lathe Hands.	Planing and Milling Hands.	Pattern Makers.	Molders.	One Year Volunteers.	Two Year Volunteers.
1. Locksmithing	8	18	3	6	..	..	1½	3
2. Turning	8	3	25	..	..	..	1½	4
Rough Turning				..	..	..		
3. Grinding	3	..	6	..	..	..	1	1½
Polishing		..		..	..	..	..	..
4. Planing	4	3	..	25	..	..	1	1½
5. Milling	4		..		..	..	1	1½
6. Gear Cutting	2	..	..	3	..	..	1	2
7. Blacksmithing	1	1	1	1	..	..	½	½
8. Hardening	1	1	1	1	..	..	½	1
9. Foundry Work	6	..	..	..	6	48	1	2½
10. Pattern Making	4	..	..	..	30	..	1	2
11. Laying out	7	10	..	..	..	..	2	4½
Erecting			..	..	..	..		
Total	48	36	36	36	36	48	12	24

TABLE SHOWING THE NUMBER OF MONTHS DEVOTED TO THE VARIOUS DEPARTMENTS BY DIFFERENT CLASSES OF APPRENTICES.

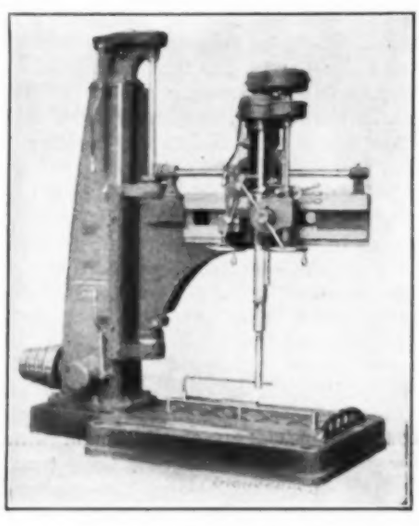


Fig. 4. Testing Drill Presses, Taught by the Aid of the Magic Lantern

able cost, and hence comparatively few German industrial enterprises have their own trade schools.

Among the apprentice schools maintained by employers are the school of the Maschinenfabrik Augsburg-Nürnberg, which has been in existence since 1890, the school of Lokomotivfabrik Henschel & Sohn, Kassel, the school of Siemens & Halske, Nonnendamm, near Berlin, and the school of Ludwig Loewe & Co., which forms the subject of this article, and which has been in existence about ten years. Until about a year ago, however, the school work was done as a side occupation by various employees of the firm, chiefly engineers, but, because of the diversion of the time and energy of these men from their proper occupations, the management of the school, the greater part of the instruction and the oversight of apprentices was transferred to me as my exclusive work about one year ago, and in describing myself I may say that I am a graduate engineer. In addition to my own work, certain engineers and teachers who are engaged in Berlin and Charlottenburg (near Berlin) continuation schools have placed certain hours at the disposal of the school. The original establishment of the school was due to Herrn Ingenieur Georg Schlesinger, then superintendent of the Loewe Technical Bureau of Machine Construction and now professor of the Technical High School at Charlottenburg.

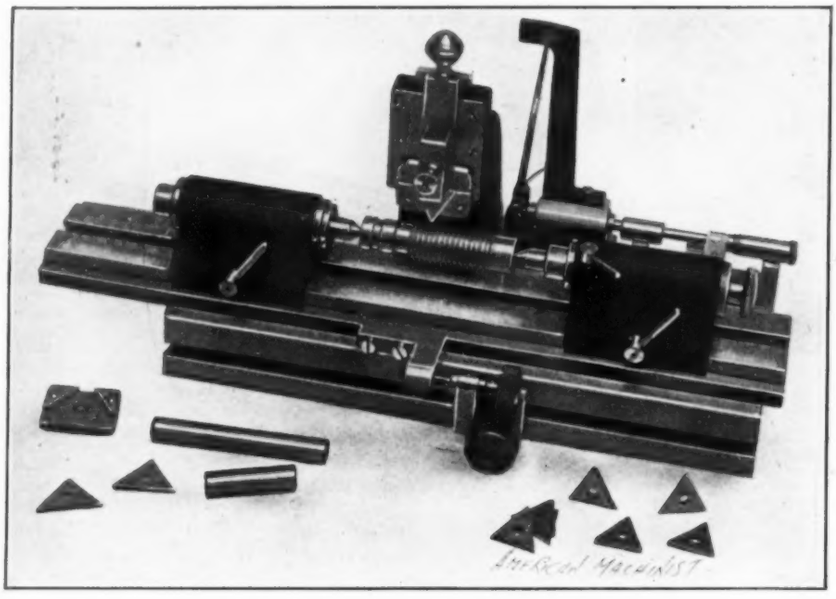


FIG. 5. TESTING SCREW GAGES, TAUGHT BY THE AID OF THE MAGIC LANTERN

CHARACTER OF THE SCHOOL

There are at present four machine-construction classes corresponding with the four years of the apprenticeship term, and also a special molding class for apprentices working in the foundry. With the exception of the molding class, each class is given a full day of school work each week. The molding class has two afternoons per week, one from 2 to 5 and the other from 4 to 6 o'clock.

All expenses are defrayed by the firm, except that drawing instruments and minor supplies are furnished by the students. In the case of needy students, however, even these are supplied by the firm. The tone of the school is thoroughly good. The instruction, as will be seen below, covers a wide range, and the well known German discipline assists in obtaining the best results. The volunteer apprentices of their own accord, and without exception, take part in the school work. This association of future engineers and workingmen is found to have an excellent effect in preventing the formation of class feeling.

The number of students now consists of 111 apprentices, of whom 19 have received high-school education, equivalent to the University entrance examination, while 20 more are beyond obligatory attendance at the continuation schools, being over 17 years old. Fifty non-apprentice boys employed by the firm likewise receive instruction at the factory by teachers of the public continuation schools.

THE SUBJECTS TAUGHT

The subjects taught are arithmetic, geometry, algebra, bookkeeping and drawing, together with a great variety of subjects of importance from the standpoint of citizenship and general intelligence. The instruction in mathematics relates closely to those operations and processes which are of immediate application to the shop work, although some attention is given to systematic mathematical training. The instruction in drawing is from the beginning specialized, although it includes such elements of descriptive geometry as are of immediate application.

GENERAL SUBJECTS

Among the subjects not strictly technical, but of equal importance to the apprentice as a future citizen may be mentioned the legal relations of the employer and employee, the rights and duties of workingmen and an outline of the history of trade guilds, including the relationship of apprentices to the guilds, together with accident insurance, patent and trade-mark law. In this connection the construction of workshops is taken up, including heating, lighting and ventilation, also the use of electric signals, standard clocks, telephones, safety appliances, rules for the prevention of accidents, hygiene and emergency service in

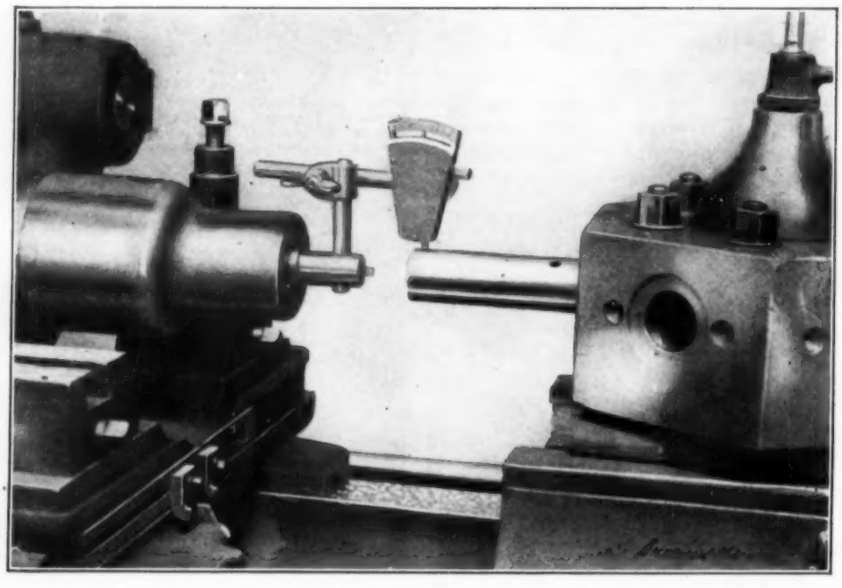


FIG. 6. THE USE OF THE TEST INDICATOR, TAUGHT BY THE AID OF THE MAGIC LANTERN

case of accidents. Attention is also given to comradeship, courtesy, order and peace, the payment of and claim for wages.

The materials of construction are also discussed—iron and steel, their production, classes and properties, the various methods of making steel and the properties of steels produced by different processes being especially dwelt upon. The manufacture of steel products by forging, rolling, the steam hammer, the forging press, sheet and wire rolling and tube drawing are explained. Similarly, copper, tin, zinc, lead, aluminum and antimony, and their alloys are properly treated.

Systems of measuring and gaging are taught, including the use of the scale, caliper, slide rule, micrometer caliper, limit gages, reference disks and block gages. The methods of laying out and many other subjects of a shop character, but suited to class instruction, are included. Some attention is given to civics and political economy, including capital, markets and the sale of products, money, credits, exchanges and banks. The constitution of the State and Empire, including the authority and functions of the Kaiser, the Reichstag, the imperial revenues and expenditures, the Kingdom of Prussia, provincial government, the government of the community, the authority and duties of burgomasters, magistrates, and other officials, the police, jurisprudence, citizens, their rights and duties, are all made plain to the future citizen.

In connection with this general work much written work is required. The student is required to frame applications for apprenticeship and suitable answers. He is taught the proper method of writing postal cards, letters and telegrams, and to prepare advertisements for help and situations wanted. He is taught how to address the public authorities, to make out bills of lading, express bills, shipping receipts, railroad package addresses, etc., and how to write receipts, promissory notes, dunning letters, postal and other orders.

Methods of Instruction

Every effort is made to make the instruction as concrete and practical as possible. Many pieces of work are brought in from the shop, including spoiled and defective pieces, and the students are encouraged to ask questions regarding things that have aroused their attention in the workshop, or that are not intelligible to them. Constant use is made of the magic lantern in connection with a large supply of slides prepared by the factory photographer, showing features of the machines made by the company, and especially methods of doing the machine work, erecting, testing, etc. Reproductions of a few magic-lantern slides are given herewith and will serve to show the great effectiveness of this instrument in familiarizing the apprentice with a large variety of subjects. In place of the imperfect knowledge acquired by the usual haphazard method of "picking up" information on these subjects, the lantern substitutes deliberate instruction and soon insures a high degree of intelligence regarding many important shop methods. Stereoscopic pictures are also used for this purpose.

The school occupies three class rooms and a drafting room in the new administration building of the works, and convenient access is provided to a roof garden, which the students may use during recesses. From the largest class room a special room for the principal of the school is divided off. On the walls of the rooms are various technical tables and charts.

The Human Side

Excursions, sports, etc., are arranged for Sundays, and at Whitsuntide there is a tour in the mountains or to the seashore, lasting several days, the expense being defrayed partly from the savings of the pupils and partly from funds contributed by the company. A library of instructive and entertaining books has been founded, and throughout the course recommendations to suitable literature are constantly made.

During the winter months, evening entertainments are given in the lecture room. These consist of lectures, recitations and musical entertainments, and are attended by the students, foremen and others connected with the training of apprentices. Prizes of books and tools are awarded semi-annually to the best apprentices.

Fair Treatment for Machine Tools

By John R. Godfrey

Too many are prone to abuse a tool and expect it to do good work and too many others have an utter disregard for the builders' instructions.

In usual practice the buyer comes into a shop and talks something like this: "I'll order a machine if you'll put in bronze bushings instead of babbitt, and lengthen out the whole bearing an inch." And the seller usually takes the order regardless of the fact that he knows babbitt is best in that particular machine, and that the length of bearing used will do better than when made longer.

I ran across a case the other day that was different. The party contemplated using a special bearing in a new machine and wrote for prices. The maker refused to quote prices until he had seen a print of the machine and saw where they were to be used. Then he sent drawings just how they should be applied and refused to sell them unless the buyer agreed to use them in just this way. This was the only way in which he would guarantee satisfaction, and he did not care to sell where they were to be used in such a way as to make dissatisfaction possible.

This sounds a bit high handed to the average buyer who is used to having every seller fall down and call him blessed for any kind of an order, but is it not the right way to sell goods? Isn't it better not to sell a machine or anything else when you are pretty sure the buyer will not use it as it should be used, and will not be satisfied? We are all too apt to think it is up to the buyer to use it in any way he sees fit, but many a good sale has been lost because a customer has not used the machine right and has advertised his dissatisfaction to other probable customers.

It is not fair to the builder of a machine to condemn it in any way, unless we are using it just according to instructions, yet how many consider this phase of the question? It is all right to experiment at times, but we should always take the blame for any failures from this cause.

And even where the builder is at fault, it is fairer to tell him frankly of the trouble and give him a chance to remedy it before advertising his faults to others. Whether he fixes it or not depends on his breadth of mind and his ability to swallow pride and accept suggestions. But we are all too apt to forget that the maker and seller has a few rights as well as the buyer. And he should not be slow in maintaining his rights, unless stress of circumstances makes it necessary for him to accept orders in any way he can get them.

A careful consideration of this point by builders and coöperation toward the securing of fair treatment for machines in use, ought to be helpful to all concerned in the long run.

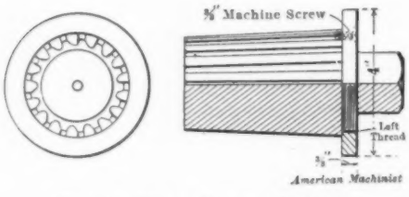
Letters from Practical Men

Concerning the details of making things in machine shops, from the first sketch to the shipping room.

A letter good enough to print is good enough to pay for. The value is in the idea—not the length of the letter.

A Self Gaging Piston Head Reamer

The line cut shows a very simple attachment on a tapered reamer that will insure all holes being absolutely duplicate without any measuring or calipering on the part of the workman. This reamer is used as a sizer and only removes 1/32 inch of metal and will hold its size for a long time in the hands of a good mechanic. It can be ground and the size maintained by placing a tin shim between the reamer and the collar. A left-hand thread is cut in the collar which prevents



PISTON HEAD SPIDER REAMER

it from backing off when it comes in contact with the piece being reamed.

W. J. SHADLE.

Gen'l Foreman C. & N. W. Rw. shops, Clinton, Iowa.

The Position of Cutting-off and Forming Tools in Turret Lathe

There is one point in even the most recent turret and capstan lathes designed especially for bar work, which if the makers paid attention to, would help the operator to increase his output.

All operators of these machines know how much better the parting and forming tools cut when placed in the back tool post of the cross slide with the cutting edge downward, than they do if placed in the front tool post.

The machines should be made so that both tools could be used upside down.

Paisley, N. B. HUGH HUNTER.

A Magnetic Vise Jaw

All who are accquainted with shaper and milling machine in the making of small parts understand the inconvenience of squaring thin pieces, owing to the difficulty of setting the work squarely and holding it so, while tightening the vise.

A little device which I have found very advantageous as well as inexpensive is the one here described. Machine a piece of tool steel as thin as conditions demand and of suitable length and breadth, harden and grind squarely to a satisfactory degree; then magnetize it strongly. Placing this in the vise it will adhere to the fixed jaw and when the work is brought in contact it will be held while the clamping is being done to the best advantage. Care should be taken to keep the face free from chips and to renew the magnetism when it has weakened.

Hartford, Conn. H. O. ALLIS.

Congress Moves Slowly

Anyone who has attempted to look up a patentee who took out a patent between 1790, the beginning of the Patent Office, and 1873, the commencement of the *Official Gazette*, probably found it more difficult that was anticipated.

There is a general index covering this period but it is arranged by subject matter and there is no corresponding alphabetical index.

It is not the easiest thing in the world to find a patentee in a subject-matter index of 1700 pages with a hundred patents to a page. When it is necessary to find a patentee in this index the first step is to guess the probable title for the invention and then to try the words of the title and those having similar meaning until the particular word is found by which it is indexed. This is not often a simple task, as can be imagined when it is considered that there are about 17 pages relating to washing machines, 25 pages relating to plows, 12 pages relating to looms, etc., each page having about 100 patents.

This condition is simply because the wheels of Government turn exceedingly slow.

The subject-matter index for this period was printed in 1874, promptly upon its compilation. The corresponding alphabetical index was prepared at the completion of the subject-matter index, and in the annual report to Congress for the year 1879, we find Commissioner Paine saying:

"I also recommend * * an appropriation of $10,000 for the publication of the general indexes of patentees, extending from 1790 to 1873, which has been in course of preparation for several years, and will soon be ready for the press."

This was repeated by Commissioner Marble in his report for 1880 in which he said:

"The general index of Patentees, extending from 1790 to 1873, which has been in preparation for several years, is now ready for the printer; but there is no money available to pay the expense of printing it. It is believed that ten thousand dollars will cover such expense, and I recommend an appropriation of that sum for that urpose."

Commissioners come, commissioners go, Congresses come, Congresses go. Years roll by and then another annual report, that of Commissioner Duell for the year 1898 stirs the dust, so long collected, in these words:

"For several years this office has contemplated publishing a general index or alphabetical list of patentees from 1790 to 1873 as a companion to the Subject-Matter Index of Patents for Inventions from 1790 to 1873, hitherto published, and which, with the annual indexes published since the latter date, will complete the alphabetical list of all persons who have obtained patents since the foundation of the Government. Most of the matter necessary for the production of this work has been prepared and is ready for the printer. There is an urgent demand for the work, and if the index could be printed by contract the money received would pay the cost of printing it, but when we are compelled to have this work done by the Government Printing Office, the estimate of cost is so great that I cannot in justice to the Patent Office bring myself to the point of asking an appropriation for the purpose. The estimate of the Government Printing Office for doing this work is over $32,000, while the estimates furnished by responsible parties show that by contract this work could be done for about one-half of that sum. I ask authority to have this work done by contract."

Much printing is done by the Government for gratuitous distribution. This index is not in that class. If it were, a delay in printing it might be excusable. It was never intended to be given away. The

price of the subject-matter index is $10. The alphabetical would doubtless be the same and would nearly or quite pay for itself if printed for reasonable compensation.

Isn't it strange that while the public is going without this index the material for its publication has been collecting dust in the Patent Office for thirty years or more?

Lowell, Mass. IRVING D. KIMBALL.

Ball Bearing Grinding Attachments for the Engine Lathe

Having to deal with a number of parting cutters, as shown at Fig. 4, we experienced some difficulty in getting the cutting corners at *A A* square.

The grinding attachment was the type shown at Fig. 1, used in conjunction with an engine lathe. The spindle had a cone end, and ran in a babbitted bearing as at *B*, Fig. 2.

To prevent the rounding off of the cutting corners, we naturally adjusted up the play in the spindle, as we found that the slightest back lash would allow the wheel to slide around to the corner of the cutter. The next difficulty was, that with the spindle so nicely adjusted and the excessive speed necessary for grinding, the bearing heated, especially when the work was of a character which gave pressure on the wheel in direction of arrow, Fig. 2.

In this case the cone of the spindle tended to lock in the cone of the babbitt. The head turner then hit on the idea of replacing the babbitt by ball bearings, as shown in Fig. 3, and as it has been at work for a considerable time now, we can recommend it as a very practical job.

We also added the spindle *C*, Fig. 3, for internal grinding, which is a simple and useful addition to this fixture.

The internal grinding attachment, as shown in Fig. 5, was also altered. As shown at *H*, the spindle had its bearing practically the whole length from *J* to *K*. This also heated quickly when tightly adjusted. The bearing *H* was split at the end, and fitted with a taper nut as shown at *L*, which served to close down the bearing around the spindle as wear took place. We replaced the end piece *H* with *I*. with hardened caps inserted at M, and in the adjustment nut at *N*. At the outer ends *O* and *P* are fiber thrust washers. The diameter *R* is the same as at *S*, Fig. 1, thus allowing the interchange of the external and internal attachments in the bore of split hub *W*.

Calais, France. J. E. EMERSON.

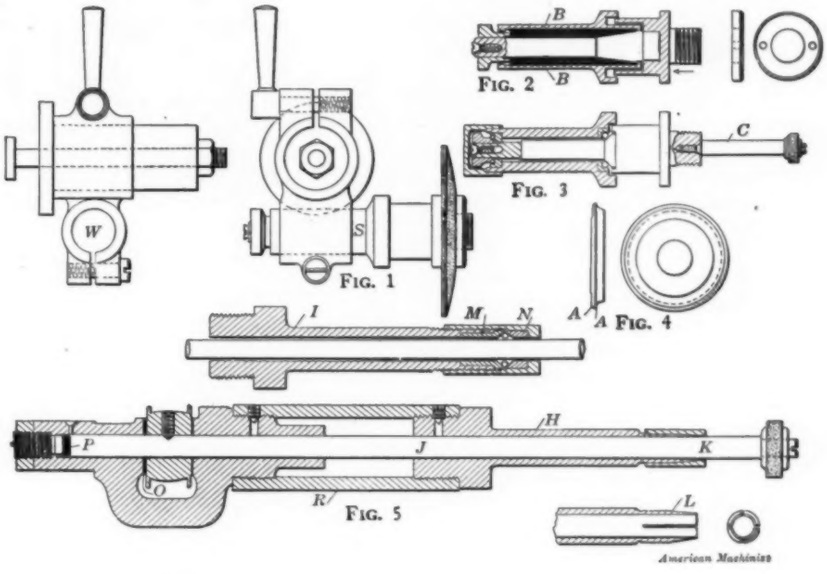


FIG. 2 FIG. 3 FIG. 1 FIG. 4 FIG. 5

BALL BEARING GRINDING ATTACHMENT FOR THE ENGINE LATHE

Making Automatic Screw Machine Cams

There are several methods of making cams for the Brown & Sharpe automatic screw machine in use in different places, of which the best is the method of milling the different lobes on the cam, as described in the AMERICAN MACHINIST'S handbook, page 123.

There are, however, cases when the cam is wanted at once, and must be made in the screw-machine department of the shop. The usual procedure in this case is to make a templet, drill out a row of holes, and break out parts. The finishing is done on the emery wheel, and the cam blank is ground until it agrees with the templet.

I have made many cams in this manner, and I find that the ordinary emery wheel does not meet the requirements, because if the cam is laid flat on the plate in front of the wheel, the cut is across the cam edge, instead of running in lines around the circumference, as it should be for a smooth cut. Again, if the cam is stood on edge, it cannot be held upright. A plate might be arranged to rest the cam against to hold it in the vertical

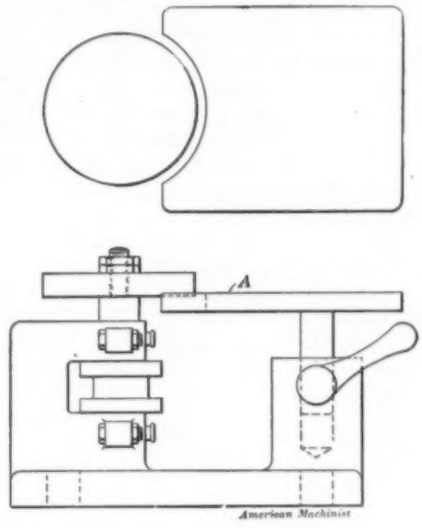


FIG. 1. GRINDER FOR CAMS

position, but the arrangement shown by Fig. 1, is far superior.

Here we have an upright emery wheel which is cheap to build, and which can be used not only for hurry-up jobs, but for all cams used in the department. After the cam has been roughed out, it is laid on the plate *A*, and ground to an etched line or a templet.

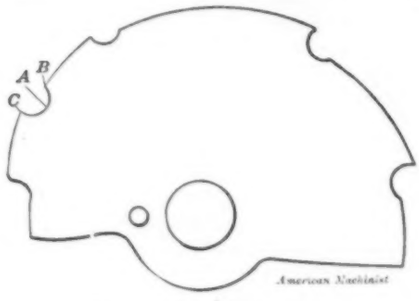


FIG. 2. A CAM BLANK

An improvement suggested to this arrangement was to place the cam on the plate, and provide the plate with a bushing, interchangeable for different sized holes, and mount the plate on a slide; this to be fed in so many thousandths of an inch (for each hundredth of the cam) by means of a fine-pitched screw, the same as operating the slide on a small lathe.

Fig. 2 shows a cam in process. The notches at *A* are first ground out on a

regular emery wheel, one-quarter inch thick.

The beginning of the lobe *B*, is ground with a wheel of small diameter, to avoid striking the corner of the preceding lobe *C*.

Boston, Mass. S. N. BACON.

Making Small Extension Drills by Brazing

Of the various methods described in mechanical papers for making small extension drills used for deep-hole drilling, I have as yet not seen one that described the making of them by brazing.

An ordinary twist drill, say number 35, is beveled off at an angle of about 70 degrees at the shank end, as shown in Fig. 1. A piece of drill rod one size smaller, to allow the drill to more readily clear itself of chips and prevent binding, is cut off to the required length, and also beveled off at an angle of 70 degrees. The two are then placed in the V-slot in

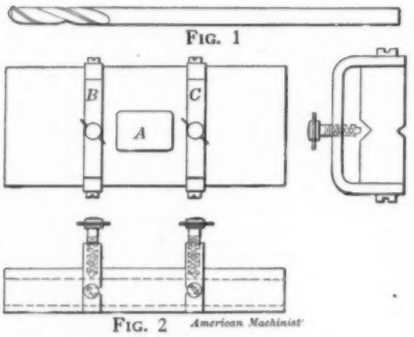


FIG. 1

FIG. 2

MAKING SMALL EXTENSION DRILLS

the fixture shown in Fig. 2, preparatory to brazing, so that the beveled ends come in the center of the slot *A*, and also in line with each other.

This fixture has two V-grooves and can also be used for soldering small tubing, etc. The parts *B* and *C*, by the aid of the two screws shown, hold the drill and drill rod in position and prevent them from turning while being brazed. These parts can readily be adjusted for use on either side of the fixture by simply loosening the screws.

The fixture is then placed in the vise so that the beveled ends can be conveniently heated by a bunsen burner, the flame coming through the slot and directly in contact with the beveled ends. Before heating a piece of wet waste is laid on the hardened part of the drill to prevent the temper from being drawn.

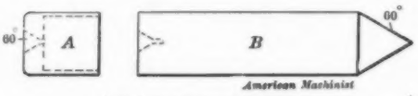
After brazing the superfluous metal from the brazing compound is filed off in a speed lathe, and the drill is ready for use.

Waterbury, Conn. CHAS. DOESCHER.

An Indicator Center

I have one of the Starrett dial-test indicators, and when I tried to use it on a jig button, I found the button was so short that the indicator would strike the work before it would touch the button, so I hit on this center which is made of tool steel hardened and ground.

The cut explains itself. The bushing *A* is made to fit the button and is counter-



AN INDICATOR CENTER

sunk at the outer end to fit the center *B* which is ground to 60 degrees. The countersunk end of the center rests on the lathe center. In use the bushing is slipped over the button and the center placed in position. The tail center of the lathe is then brought up snug against the indicator center. By placing the indicator as close to the button as possible, the slightest untruth of the button can be determined by turning the lathe.

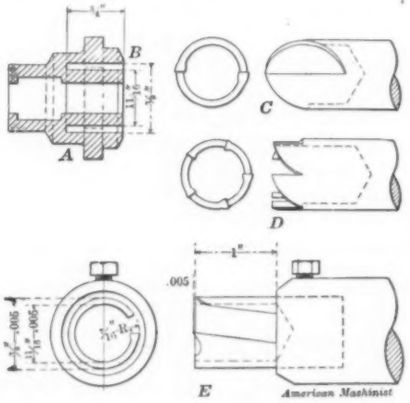
JAMES K. CLOUD.

Logansport, Ind.

The Tools for Cutting a Slot in a Valve Bonnet

At *A* is shown the bonnet, in section. It is part of a brass valve and the difficult part was to make a tool which would cut the slot *B* and not break.

The first tool *C* had two cutting edges, as shown, and while it worked all right in the engine lathe when experimenting, it would not work in the turret lathe satisfactorily and gave a lot of trouble by breaking. The tool *D* was then made with five teeth but this also broke repeatedly.



TOOL FOR CUTTING SLOT IN VALVE BONNET

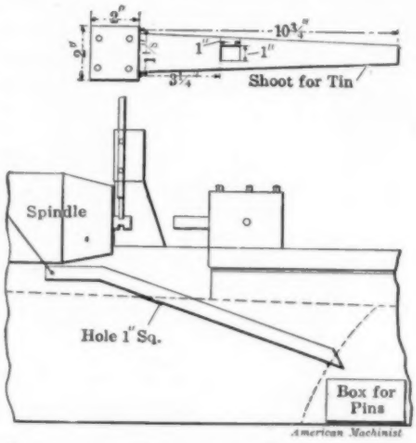
It was found that the breakage was caused by the tools digging into the work. I then made the single-tooth tool *E* which is perfectly straight in front with the exception of the cutting edge which projects 0.005 inch beyond it. This tool cannot dig in and clears itself of chips very readily.

PETER SIEBOLD.

Philadelphia, Penn.

Separating Small Pins from Chips and Oil

We were making a lot of 28,000 pins ¼ inch diameter, 5/32 inch long, on a Hartford automatic and had all kinds of trouble picking them out of the chips and oil, taking longer than it did to make them. I made a chute of tin shown in the cut, which not only kept them from the chips but kept them practically free from oil. The chips, being light, would be washed down the hole by the oil, while the pin being heavier, would bound over



SEPARATING WORK FROM CHIPS AND OIL

the hole and down the chute into a box with holes punched in the bottom, allowing the oil to drain off.

Springfield, Vt. H. C. M.

Course of Lectures

An interesting course of lectures has been arranged by the Stevens Engineering Society, Stevens Institute, Hoboken, N. J., to be delivered at the institute at 4 p.m. on the dates and subjects given:

"Membership in Engineering Societies;" Alexander C. Humphreys, October 18.
"Design and Construction of a Central Station;" Irving E. Moulthrop, November 1.
"Art and the Engineer;" James P. Haney, November 15.
"With Peary in the Arctic;" Donald B. MacMillan, November 22.
"Services of Chemistry in the Promotion of Public Welfare;" Harvey W. Wiley, November 29.
"The Story of an Island;" Rossiter W. Raymond, December 6.
"The Origin of Petroleum;" David T. Day, December 20.
"The Kimberley Diamond Mines;" Gardner F. Williams, January 10.
"The Development of the Railroad on the North American Continent;" James Douglas, January 16.
"The Catskill Water Supply Project;" John A. Bensel, February 7.
"The Electric Furnace;" Carl Hering, February 14.
"Reclamation;" F. H. Newall, February 20.
"Metallography as Applied to Engineering;" William Campbell, March 7.
"Radioactive Phenomena;" A. Stanley MacKenzie, March 21.
"Illuminating Engineering;" George E. Hulse, April 4.

Machine Tool Builders' Convention

Editorial Correspondence

Annual meeting in New York the largest and most successful in the history of the organization.

Transaction of formal business and presentation of several interesting and pertinent papers.

The convention of the National Machine Tool Builders' Association, held at the Hotel Astor, of this city, October 25 and 26, was the most successful in point of attendance and sustained interest that the association has held. The past year has seen a marked increase in the membership, as shown by the following list of new members:

Acme Machine Tool Company, Cincinnati, O.; Bardons & Oliver, Cleveland, O.; Blanchard Machine Company, Cambridge, Mass.; J. G. Blount Company, Everett, Mass.; Cincinnati Pulley Machinery Company, Cincinnati, O.; Cleveland Automatic Machine Company, Cleveland, O.; Cleveland Planer Works, Cleveland, O.; Fay Machine Tool Company, Philadelphia, Penn.; Frontier Iron Works, Buffalo, N. Y.; Gardner Machine Company, Beloit, Wis.; Gleason Works, Rochester, N. Y.; Grant & Wood Manufacturing Company, Detroit, Mich.; W. B. Knight Manufacturing Company, St. Louis, Mo.; Lapointe Machine Tool Company, Hudson, Mass.; Lea Equipment Company, New York City; Lees-Bradner Company, Cleveland, O.; Milwaukee Machine Tool Company, Milwaukee, Wis.; Morse Twist Drill and Machine Company, New Bedford, Mass.; National Machine Company, Hartford, Conn.; Newton Machine Tool Works, Philadelphia, Penn.; Putnam Machine Tool Company, Fitchburg, Mass.; Ransom Manufacturing Company, Oshkosh, Wis.; Robbins Machine Company, Worcester, Mass.; Sloan & Chace Manufacturing Company, Newark, N. J.; Willard Machine and Tool Company, Cincinnati, O.; Wilmarth & Morman Company, Grand Rapids, Mich.; Wood Turret Machine Company, Brazil, Ind.

By every test that can be applied, the association is now in a more flourishing condition than ever before.

The session of Tuesday morning was opened with the usual formal proceedings—roll call, reading of minutes, appointment of convention committees, reports of officers, etc., following which came a brief report of the patent committee, which reported encouraging progress toward the establishment of a court of patent appeals, which is expected to come up for definite action at the next session of Congress.

Cancelation of Orders

Following this came a report of the Committee on Cancelation of Orders and on Dealers' Commissions, by the chairman, C. Wood Walter. The committee had acted in coöperation with a corresponding committee of the National Supply and Machinery Dealers' Association, the recommendations offered at the end of the report representing the joint action of the two committees.

The report pointed out that the custom of canceling orders had grown up in defiance of the law, which is all against the custom, and the problem before the industry is the bringing about of a change in a recognized custom. As a result of their deliberations, the two committees had recommended the incorporation in quotations and order acceptances of the following clause: "Kindly note that all our quotations and acceptances are made subject to the understanding that the order is not subject to cancelation, provided shipment is made within the time specified."

The report of the committee was subject to active discussion, after which it was unanimously adopted. The discussion consisted largely of inquiries regarding the degree to which the action proposed was binding on the members, the reply being that it did not and was not intended to bind anyone, but to bring about a change in custom by placing before every customer the fact that such a change is to be inaugurated. It was regarded as a first step to be followed by others should they be needed.

Commissions to Dealers

As regards dealers' commissions the committee reported, as the result of their deliberations regarding the request of the National Supply and Machinery Dealers' Association for an increase in commissions to cover a claimed increased cost of selling, that action on the subject is outside the competence of the association. The committee considered a uniform rate of commission on all products of the members of the association to be clearly illogical, and that, varying commissions being accepted as necessary, action by the association would lead to an invasion of the freedom of individual members in the management of their own business.

Ball and Roller Bearings

The session of Wednesday morning was opened by the reading of a paper by Henry Hess, on "The Use of Ball or Roller Bearings in Machine Tool Construction." As we expect to reprint this paper in the near future, it is unnecessary to make an extended report of it here. It was received with a marked degree of interest and brought out considerable discussion as regards particular applications, to which the author replied with additional information, which we trust will be ultimately incorporated in the paper.

Shop Floors

Mr. Hess was followed by James N. Heald, who read a paper on "Concrete vs. Wood Flooring for Machine Shops." This paper appears elsewhere in this issue.

The discussion of the paper likewise was excellent and extremely instructive. Mr. Hess gave the results of his observations and experience in connection with the floors of the German Niles Tool Works, in which he had adopted a type of floor which he found in large use in Germany, but which is not used in this country at all. The experience with the floor has been entirely satisfactory, Mr. Hess's remarks supplying a distinct item of valuable information to American factory owners.

Advertising

Following this came a paper by Thomas H. Moore, advertising manager for John Wanamaker, on "Advertising—Large Space in a Few Papers vs. Small Space in a Number of Papers."

Mr. Moore announced at the start that the subject as given to him was scarcely capable of adequate discussion, and, as a matter of fact, his paper was far more general in its scope, and of a character which is scarcely capable of presentation in abstract. It led to considerable discussion, of which the chief point related to the percentage of gross sales which should be expended in advertising. The formation of good mailing lists was also discussed, and Mr. Hess described his method of distributing data sheets as being extremely satisfactory in bringing out inquiries from those who made desirable additions to his mailing list.

Apprenticeship

Mr. Moore was followed by E. P. Bullard, Jr., chairman of the Apprenticeship Committee. He reported a large amount of interest in the form of apprenticeship contract which has already been approved by the association, saying that fifteen members of the association are now giving diplomas to those apprentices who have completed their course, 158 such diplomas having now been granted. Formal request has also been received from the National Metal Trades Association for permission to make use of the contract.

This report also brought out an active discussion, which related largely to the legal enforceability of the contract. It appears that in some of the States of the Union there are no laws making a legally enforceable contract possible. Apart from this, the prevailing opinion as expressed in the discussion was that, given such laws, the compelling of an unwilling apprentice to complete his term was not profitable or desirable. Mr. Bullard pointed out, however, that in their case the agreement had been very successful in holding the apprentices to the end of their terms, their loss of apprentices since adopting the association's form of agreement being but 3 per cent. Mr. Lodge gave instances which showed the value of such training as that given at the Ohio Mechanics' Institute. His belief was that the value of training of this kind should be recognized in apprentice agreements by a shortening of the term by perhaps a year, and by starting the apprentice at the rate of wages provided in the schedule for the second year. Mr. Geier considered that the chief responsibility for the present situation lies with manufacturers, too many of whom fail to recognize their responsibility in training a competent body of workmen.

Machine-tool Design

The session of Wednesday afternoon was opened by the reading of two papers on the "Design and Construction of Machine Tools from the User's Standpoint," by G. K. Lassiter, mechanical superintendent of the American Locomotive Company, and John Ridell, mechanical superintendent of the General Electric Company, Schenectady, N. Y. Mr. Riddle's paper will appear in these columns in the near future.

These papers contained a wealth of suggestions, which can scarcely fail to benefit the machine-tool industry. Mr. Lassiter referred to the organization of the American Locomotive Company, by which accurate record is kept of all machine-tool failures and their causes, and of the marked success of this organization in reducing the cost of repairs and the percentage of idle machines. He explained the policy of his company in having many of its machine tools built to its own specifications, a leading feature of which is a reduction in the amount of gearing, and the mounting of the motor with as short a transmission as possible between it and the working spindle. He gave the results of certain tests in connection with drilling machines doing heavy work, in which the reduction of the power required to drive the machines had been fairly startling.

Concluding Business

Following this came the report of the Resolutions Committee, with various recommended resolutions, all of which were adopted. These provided for a special committee to investigate the desirability of incorporating the association, a committee to compile a classified mailing list for the use of members of the association, and a resolution suggesting the desirability of the National Supply and Machinery Dealers' Association holding their fall meeting at the same time and place as the Machine Tool Builders' Association. The concluding resolution was one of sympathy to J. B. Doane for the loss of his brother.

Following this came the selection of Atlantic City as the place for the next meeting of the association, and following this the final business of the meeting—the election of officers. The new officers are: F. A. Geier, president; C. H. Alvord, first vice-president; F. H. Reck, second vice-president; A. E. Newton, treasurer, and C. E. Hildreth, secretary.

The election of the new officers was received with the abundant enthusiasm that pervaded the entire proceedings of this year's convention to a greater degree than ever before.

Machinery's annual outing on Thursday, the 27th, was as usual a very interesting and enjoyable feature, at the close of the convention and was favored with traditional *Machinery* outing weather. The trip this year was by steamer to Sea Cliff, Long Island, where a party of several hundred was entertained at luncheon. The afternoon was devoted to sports of various kinds, including potato and relay races, foot ball and push ball matches.

Concrete versus Wood Flooring*

By J. N. Heald †

A discussion of the relative merits and demerits of two types of flooring for shop use drawn from the experience of advocates of both types after actual use.

*Read before the National Machine Tool Builders Association convention.
†General manager, Heald Grinder Company.

Inquiries were sent out, asking two questions: First, are you using concrete floors at present, and are they satisfactory to you and to the workmen? Second, if you were to build a new shop, what would your experience lead you to use for floors, and how would they be constructed?

Forty replies were received. Eight distinctly favored concrete floors for machine-shop use; 26 were decidedly in favor of wood, and 6 were favorable to each, under certain conditions and for certain work.

These reports, with only one or two exceptions, came from those operating machine shops, although 16 were not machine-tool builders. All of the 8 who preferred concrete have had experience with both wood floors and concrete floors. Seventeen of the 26 who prefer wood floors have actually had experience with both, the other 9 based their preference for wood upon investigations made by them when looking up this matter for their own benefit.

Experience with Concrete

The general point of view can best be given, perhaps, by two or three extracts from the letters sent, and I will quote, first, one in favor of concrete, written by the president of one of the leading machine-tool builders of the country, which you will recognize readily from being located in a beautiful country town in southern Vermont.

"We built a three-story cement and steel building in 1904, and in 1907 we put up a saw tooth, single-story building. In both of these buildings we have used concrete floors, without wood. We noticed the men who were accustomed to stand on a wood floor became more foottired, at first, in the cement building, and possibly those whose work gave them an opportunity to move about were also slightly affected in the same way, but as for this we are not sure.

"We do know, that in these buildings with cement floors we provide a thin platform of wood for men who do not move about. We do not find it necessary to provide it for others. The planer and the bench hands, whose work calls for standing in one position most of the time, need the wood insulation.

At first we thought it was the difference in the hardness of the material, and in fact, this may be one of the reasons why it is more tiresome, but the Aberthaw Construction Company put out a circular on this subject, in which it was suggested or stated that the reason cement floor was objectionable was that it carried off the heat from the men's feet faster than the wood, which is not so much of a conductor of heat, and that, with the same temperature, this greater heat conductor produces the undesirable effects, and in that paper we think it used the comparison of the difference in feeling to the hand of an iron and wood surface of the same temperature. Among

other objections was that the cement was supposed to increase rheumatic troubles. We have had no such complaints, and have felt that the advantages more than offset the disadvantages.

"It makes a cleaner and more wholesome shop, one in which it is possible to clean the floors free from all of the objectionable matter that accumulates in the cracks of wood floors, and it also makes possible the introduction of cuspidors cast directly in the floor, into which we run a flushing stream at regular intervals.

"If plants could be heated through simply warming the floor, as we believe has been suggested, then the only serious objection to the cement floor would be removed. It is possible that the hollow tile may serve for this purpose. I refer to the hollow tile made by the National Fire Proofing Company. A layer of this tile with openings registering the entire width of the building, and connected with conduit pipes on the lines already suggested, would give a very even distribution of heat and would not make an expensive floor, although the total thickness would have to be probably 2 inches under and 2 inches over the cement, with hollow tile of 4 or 6 inches, according to the load.

"This would bring the temperature of the floor up closer to that of the workmen's feet, and would make the floor the warmest part of the building, and do away with pipes of all kinds. It might not be necessary to have any immediate openings into the room, excepting for a slight circulation. There is no reason why steam pipes could not be put in the same openings.

"There remains the element that always enters into the use of concrete, which must be seriously considered by anyone building more than a one-story building. A few shovels of earth without the proper amount of cement, or a few shovelfuls of inferior material instead of sharp sand, may happen to be placed where it will cause serious disaster, but we have had no experience of this kind."

Three Advocates of Wood Floors

Among the letters favoring wood floors, the following will be of interest. The first comes from a leading manufacturer of twist drills in Cleveland, O.:

"We have one building in our group made all out of concrete. This building is three stories high and all the floors are concrete. We have been greatly disappointed in the concrete floors. In the first place any water spilled on one of the floors filters down through to the next. These floors are not suitable for trucking shop trucks over them as they chip out and wear in grooves. Our men do not like them and complain of the effect that standing on the concrete floors has upon their legs. This may be imaginary but it is to be considered.

"We have recently made an experiment on these floors by covering them with about two inches of first-class paving asphaltum put on by the company that does the asphaltum paving in this city. So far we think this is an improvement, and another year may extend this coating over all the floors in this building.

"In our judgment the best floor for a factory is narrow matched maple. It wears smoothly and is easily repaired."

The second is from a manufacturer of automobile parts in Detroit, Mich.:

"We are using concrete floors in our factory building, which is devoted to light machine-shop manufacturing operations.

"From our experience so far, we are quite firmly of the opinion that this is a decided mistake, and that wood floors would be much better and more economical in the long run for such occupancy. While there have been some few cases of complaint from workmen, this has not been at all serious. So our objection to concrete is more on the score of its being unsuitable as a wearing and working surface in general as applied to machine-shop operations.

"As a matter of wear, we find it giving way much more rapidly than we had anticipated, while due to this and at the same time aggravated by the presence of metal chips and oil, it is rather difficult to keep clean.

"Another and serious objection to concrete, is the invariable damage suffered by tools and finished pieces of work dropped upon it. One inch to one and one-half-inch by three-inch maple is generally considered to be the best flooring material and is what we should use in future."

Some Details of Construction

The third and last from a manufacturer in Stamford, Conn.:

"We take pleasure in giving you our experience in connection with flooring and floor material, as follows:

"We have in two instances in our factory examples of pure concrete floors on which active manufacturing is being conducted and in both cases, during the winter months, we have trouble in keeping the men comfortable in these rooms. The reason undoubtedly is due to the fact that the concrete floors abstract the heat of the body from the feet, chilling the blood and consequently producing a feeling of discomfort which is attributed by the employees to want of proper heat in the room.

"The main portion of our factory is composed of wooden floor of three thicknesses; namely, a supporting floor of sufficient strength underneath, an intermediate floor and a top-wearing floor of maple. We find that this construction of flooring gives us excellent satisfaction from the standpoint of the employees and likewise has the advantage of being readily repaired by replacing the upper surface without disturbing the main features of the construction of the building.

"In two of the buildings we have used the reinforced-concrete form of construction as far as the floors and columns are concerned, and in this instance we have put screeds in the concrete, nailing down an intermediate floor and top-wearing floor of hard maple as above. This method has given excellent satisfaction and the writer has had the chance of studying, from his own personal feelings, the effects of such a floor on account of our main office being laid in one of these reinforced-concrete buildings.

"On the ground floor, we have used a method of tar concrete for a depth of four inches in which are buried screeds, and an intermediate floor and top maple floor, as in the above examples cited. This method for the ground-floor work is highly satisfactory, as it keeps out the dampness and preserves the floor. The writer had the experience within the past six months of taking up a portion of a floor of this character, which had been down thirty years. The under flooring and screeds were just as clean and well preserved as if they had just come from the lumber yard.

"In cases where we have found sensitive persons complaining as to the conditions arising from the use of concrete floors, we have made a lattice of wood for the employee to stand upon with a marked improvement in his apparent physical comfort."

The Effect of Granolithic Floors on Operatives

In considering this side of the matter some allowance must be made for the fact that the average workman is liable to be prejudiced against anything to which he has not been accustomed, and that he is therefore prepared to complain of a granolithic floor. It is claimed by some of the advocates of concrete floors, that the real cause of the workmen's complaint is undoubtedly the coldness and not the hardness of concrete floors. Everyone knows that the coolest seat on a hot day is a stone doorstep, and like the stone step, the concrete floor feels colder than the wood floor.

When a concrete floor is in contact with the ground, it actively withdraws heat from its inner surface because it is a good heat conductor. At all seasons the concrete floor feels colder than the wood floor and the effect of this on the operator who stands for hours in one place is gradually to chill his legs and thus check the circulation in them.

In some shops the operators not only bring in boards and the like to stand on, but have gone so far as to wear heavy overshoes during working hours. The actual heating of the concrete floor-slab itself by means of contained steam pipes or hot air ducts arranged in the substance of the flooring has proved remarkably

successful in the plant of the Morse Chain Company, of Ithaca, New York.

In this plant, which was described in the AMERICAN MACHINIST, page 231, Volume 33, Part 1, the workrooms are heated by radiation from the concrete floors, with no direct admission of hot air except in extremely severe weather.

The experience of the Morse Chain Company seems to demonstrate that workmen have mistakenly attributed the effects of the cement floor to its "hardness," when in fact it was the "coldness" which was to blame.

WEARING QUALITIES

Taking up now the requirements of satisfactory floors of concrete, we come first to the wearing qualities:

Liability of granolithic to wear into hollows, or ruts, under heavy trucking.

Dust, due to abrasion of the floor surface, which is sometimes merely disagreeable, but which in some cases works damage to machinery and product.

The difficulty of making effective repairs in granolithic finish.

Trouble in attaching machines to granolithic floors.

Trucking, as shown by the letters received, develops quite a little trouble, especially where the concrete blocks are marked off into squares, as is usually done. It would be much better so far as this point is concerned, if the marking off of the squares was omitted in such floors, which is done partly for looks and partly that any cracks which develop may run through these markings and in that way not show in the level surface.

A suggestion by an advocate of cement floors, is that flat iron bars slightly separated and not on edge be imbedded in the floor in the direction in which the trucking is done, and in that way take the wear of the trucks and save the concrete; this being better than solid flat plates, which become polished and therefore very slippery.

CARING FOR THE FLOOR

The question of dust has been struggled with by all the advocates and builders of concrete floors. Various paints are offered to prevent this, but they are of very little value; the floors can be kept painted, but the expense of this must amount to quite a little. No film, as thin as the average coat of paint, will permanently resist the usual wear of the shop. It is claimed that a boiled linseed oil thinned with gasolene or naphtha, until it will run into the pores of a porous surface oftentimes prevents trouble and is cheaper than some of the floor paints. This preparation is incidentally a good waterproofing for porous surfaces, as well as a preventative of dust.

In the matter of repairs, the granolithic surface is obviously at a disadvantage compared with wood, because of the difficulty of firmly bonding new material to the old.

The difficulty of attaching machines to the concrete floor is probably overrated by those who have had no experience in this line. Many of the later types of machine tools are so heavy, so well designed and so self-contained that they require very little, if any, attaching or bolting to the floor, and therefore the drilling for plugs into which screws can be driven, or the use of expansion bolts, should be a comparatively simple matter, and this point should not claim much consideration.

The breakage of parts in process is something that must be considered individually. If manufactured articles are delicate and finished all over, there is risk of serious injury to them in dropping on the floor, which would not be the case with a wood floor. Therefore, if the article being manufactured is fragile, the wood floor is quite desirable.

There is little doubt that the concrete floor can be kept cleaner than the wood floor, with its many cracks, which are usually full of dirt. What dirt accumulates on the concrete floor is right on the surface and can readily be taken up.

Experts claim that waterproof granolithic floors must be trowelled hard in order to make the surface durable, and that this trowelling also makes it practically waterproof. This prevents leakage of water that may get upon the surface, except at joints, and possibly in places that have been worn by use. The extent of damage would be simply whatever was done by the leaking water in the room below. The conclusions are, that the highest success in the construction of a granolithic floor surface can be obtained only by following very carefully correct principles of construction and certain methods of manipulation, in order that the surface may be able to give the service expected of it.

There are certain situations where, in spite of its higher cost, the wood top floor is probably better than granolithic surface for the owner to put in, simply because his case may require certain qualities which the wood top can provide, and which no masonry surface can give, and which he must have, even at a higher first cost.

A COMPARISON

The virtues of a wood floor are inherent in naturally formed material, whose fitness is apparent at a glance. Saw up the tree, season the sawed and planed strips, let the carpenter make them into a floor, and you have a wearing surface of certain high, recognized value.

With the granolithic surface in concrete, it is necessary to select cement and other materials for certain qualities which are not evident in the appearance of these materials; correct proportions must be determined; materials must be put on the right kind of surface and at the right time, and manipulate them in just the right manner. The green surface must be protected for a certain number of days while it is setting. The mere statement of the procedure necessary with the granolithic finish is enough to show that the average granolithic floor will be more or less unsatisfactory, because the average concrete workman is inclined to hurry, and is often poorly informed as to the procedure necessary for getting a good surface, and for that reason to a large extent, the success or failure of a granolithic surface comes down to the question of workmanship.

There is one other feature which is often overlooked concerning concrete floors and wood tops, and that is the comparative thickness that is necessary for the two kinds. When concrete alone is used, the entire thickness of the slab, including that portion which is put on for the finish, if properly handled can be bonded together and made to give strength as a single slab carrying no dead weight. With the concrete floor made with a wood top, the concrete slab should be just as thick as in the first case, but in addition to its own weight, it has the weight of the screeds which are put on, also the weight of the cinder and concrete filling between the screed, and not forming structurally a part of the floor slab. Also the weight of the planking in the under floor, together with ⅞-inch maple top floor, which altogether reaches a much higher total figure than might be supposed by anyone who has not gone into the engineering side of the matter.

If 6- or 8-inch concrete slabs were sufficient to support the load of any given floor, provided it was of concrete, a slab thicker than this would really be required when it was to be covered with a top flooring of wood, and the accompanying screeds and tar concrete necessary in this other type of construction. This, of course, adds to the expense and to the time required for putting in the floor, because the concrete should be thoroughly dried before anything is done with the wood floor above it. Time must be given to dry the slab out thoroughly before the kiln-dried stock is put in place, else the floor will swell, curl and make trouble. If, when the slab is still damp, waterproof paper is laid between the under flooring and the top flooring, it is almost certain to cause rot in the under flooring, and make trouble later on.

ANOTHER SUGGESTION

In accordance with the suggestions made in some of the letters that I have received, it seems as though a very desirable floor can be made by using a concrete base, afterward covered with a thin layer of pitch or tar concrete, in which screeds are set and carefully leveled up, then filled between with soft concrete leveled off flush with top of the screeds;

(*Continued on page* 849)

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American Machinist

Editorial

The Magic Lantern in the Shop School

The article which we print on another page, regarding the shop school of Ludwig Loewe & Co., Berlin, will, we believe, be read with much interest, if for no other reason than that it shows that the problems which confront American manufacturers are not confined to our borders. It is not to be supposed that this school is conducted from purely philanthropic motives, but that it has largely a business basis and that its main reason for being is the increased efficiency of the working force due to the school training.

Of the details of the school work the most striking single thing, in our judgment, lies in the use of the magic lantern, which, so far as we know, has not yet been generally used in American schools of the same character.

In view of the universal use of this instrument in other fields of educational work, it may seem superfluous to point out its usefulness in this field, but in view of its newness in this field, that is scarcely true. The illustrations which are included in the article tell their own story and make arguments superfluous. In sizing up the value of the instrument it must be remembered that it is not used in a large audience hall, with many of the spectators distant. On the contrary, the size of the classes is naturally such that all may be within easy seeing distance and that the shop operations may be brought before them almost as vividly as in the shop itself.

The subject is one on which one might be excused for becoming enthusiastic. This placing at the teacher's command of realistic representations of important shop operations, regardless of their actual progress in the shop and as wanted for purposes of instruction in a class room, where they may be explained and duscussed without interfering with the shop work, and be presented in orderly sequence, opens up a method of shop teaching of the first order of importance.

The ful usefulness of the instrument is by no means indicated by the illustrations shown. No shop can supply all of the material which a capable teacher would want, but the ever-ready camera provides the means of gathering such material from other sources. The columns of papers like our own offer a wealth of material, which, properly used, would enable the teacher to place before his pupils almost every conceivable phase of shop work.

The shop school idea is fairly launched in this country, and this suggestion from Germany deserves the serious attention of those who are interested in it.

Drilling Points to Be Considered

Although drilling is one of the most common shop operations, there is too little real study given to it in many shops. Makers of drills have probably given it more study than anyone else, more than the makers of drilling machines in most cases.

Small drills require a higher speed than it is possible to obtain on many machines, the feed being limited by the strength of the drill, so that any increased production must come from the speed at which it can be run.

On large drills, the feed is more important, the increase in diameter making it much easier to secure proper cutting speed, but the feed requires a much heavier pressure to force the drill into work so as to cut a proper chip.

Here we are confronted with the question of proper grinding of the lips and point, to give a clean cut and reduce the scraping action of the point to the maximum. Then there is the drag of chips between the relieved portion of the drill and the hole, the chip clearance in the groove and the question of lubrication.

The grinding also presents other questions than the shape of the lips and point. The work done for each grinding, and the question, of how often it should be ground, from the point of work done, power consumed and life of drill, must also be considered.

We are too apt to make tests or make records for one or two points only, instead of considering all the conditions which go to make up a complete total. The true test of a drill must be the total cost for the work done. This includes first cost, cost of grinding, and power consumed. These measured against the number of inches drilled or metal removed give a fair basis for comparison.

Opportunities of Advancement

Too many workmen believe that there are few opportunities for advancement. Far too many men think that luck brought a deserving workman to the attention of the management and that it was luck that caused his promotion. While this is sometimes true, few workmen realize to what extent managers and superintendents are always on the lookout for men who can accomplish results. Few appear to realize that there are not many who really deserve to rise above the grade of first-class mechanic. There has never been more complaint than at present regarding the lack of competent men for positions of authority, and many managers throughout the country are seeking such men with but little success.

Nearly every manager prefers to promote from the ranks of his own establishment, and usually will go outside for his supervisory force only when he is unable to secure satisfactory men from his own force.

The usual complaint from managers is lack of a combination of thoroughness, initiative and force on the part of men in carrying out undertakings assigned them. A workman will doubtless think and say that a mechanic has little opportunity to display initiative and force unless he be placed in a position of responsibility. This is true, but the manager must judge of what is in the man from the work he does. If a man will consistently do his work thoroughly; if he will show real interest in the work, the management will soon learn of it and will be quick to give him an opportunity by actual trial to show that he possesses the other qualities requisite for a foreman or superintendent. The opportunity is never lacking for the workman who can accomplish results and merits advancement.

Teaching the Question of Cost

Every teacher or instructor in shop work, whether in the school or shop, has an excellent opportunity to impress the boy with one of the vital factors of all manufacture, the cost of doing work.

All shops feel the need of good men who can size up a job quickly and give a fairly close estimate of the cost of doing it. Such men are in demand and they can be trained much more readily if the subject is given a little attention in training the boys.

There has been a tendency in some cases to keep the question of cost in the background, so far as the men in the shop were concerned, on the ground that this was only for the eyes and knowledge of the office end of the business. But the best results are always obtained where there is complete coöperation between all departments and this is no exception to the rule.

Teaching the boy the cost of work, and the cost of materials makes him appreciate more and more the necessity for cutting down spoiled work and other wastes. It puts him in the way of becoming more valuable to his employer and to himself, and should tend toward a higher efficiency in the production of any shop.

This will also add variety to the work of the teacher, and will afford another means of interesting the boy in it.

Building Machine Tools for Stock

Some of the well known builders of machine tools are working on stock orders instead of laying off men and curtailing production with the first sign of a slackened demand, which is believed to be but temporary.

While building for stock ties up considerable capital, its advocates feel that it is cheaper in the long run and a real economy if all points are considered. There is no question as to the cost of production being lower when carried on at the normal rate with the regular organization. Hiring in extra men or putting on a night force almost invariably increases the cost of production and too frequently lowers the quality of the work. Both of these added costs would often go quite a ways toward paying interest on the capital invested.

Another advantage of having machines in stock is that it effectually overcomes the question of the cancellation of orders which is now being vigorously discussed in many quarters. Building for stock is, of course, out of the question for special machines and, unfortunately, for concerns with small capital, but it is well worth considering where conditions warrant it.

Wasteful Economies

Probably the most wasteful practice that has come down to us from the old shop is the habit of thinking that "making things ourselves don't cost anything." There was reason for this in the old days, when supplies could not be easily obtained and when prices were almost prohibitive, owing to the small quantity manufactured. But these reasons have largely disappeared.

Take as an example the practice of making small wheels for internal grinding from pieces of a larger broken grinding wheel which has been explained by several of our correspondents in recent issues. We believe it is bad practice in any case unless it is impossible to secure the wheel without undue delay, which is not often the case.

The real follies of such a case are fully set forth in another column. It is an easily acquired habit, almost a natural one in many cases, but it should be carefully guarded against.

PERSONALS*

E. R. Abbott, formerly with Joseph Merritt, Hartford, Conn., has accepted the position of manager of the United Engineering Company, Bridgeport, Conn.

George W. Williams, until recently on the engineering staff of Brill & Gardner, Chicago, Ill., has been made manager of the Chapman Engine and Manufacturing Company, Ltd., Dundas, Ont.

Ernest B. Sellew, formerly chief draftsman of the Potter & Johnston Company, Pawtucket, R. I., has become president and manager of the Sellew Machine Tool Company, Pawtucket, R. I.

George H. Buckley, formerly connected with the Salisbury Wheel and Manufacturing Company, has been appointed general superintendent of the Greenville Metal Products Company, Greenville, Penn.

George E. Crofoot, who has been a member of the mechanical-engineering faculty of the University of Pennsylvania, has joined the engineering staff of the Browning Engineering Company, Cleveland, O.

J. Frederick McCloskey, who, for the past 9 years has been superintendent of the Taft-Peirce Manufacturing Company at Woonsocket, R. I., has accepted a position with the United Shoe Machinery Company, Beverly, Mass.

Charles A. Howard, who has been manager of the turbine department of the E. W. Bliss Company, Brooklyn, N. Y., has become associated with Gunn, Richards & Co., New York City, and will act in the capacity of mechanical engineer.

Frank C. Armstead, who has for a number of years been supervising engineer of the stoker department of the Westinghouse Machine Company at Attica, N. Y., has transferred his headquarters to the New York office of his company.

Louis R. O'Neill, who has been identified with the Board of Education in Bridgeport, Conn., in connection with the industrial-education movement, has accepted a position with the Union Typewriter Company, Bridgeport, Conn., to be engaged in designing work.

Albert E. Guy, who, for the last six years has been at the head of the engineering department of the De Laval Steam Turbine Company, Trenton, N. J., previous to which he was in the Bureau of Steam Engineering of the Navy Department, has resigned in order to accept the presidency of the Standard Pump Company, 30 Church street, New York City, which will engage in the manufacture of the Guy centrifugal pumps.

*Items for this column are solicited.

New Tools and Shop Appliances

A 26-inch Triple Geared Shaper

The halftone shows a new 26-inch triple-geared shaper, recently brought out by the John Steptoe Shaper Company, Cincinnati, Ohio.

All of the shaft bearings in the column of this machine are bushed with cast-iron bushings and provided with ring oilers. The shafts have spiral oil grooves, to insure distribution of the oil.

The ram is driven by means of two rack gears of large diameter. The teeth in the rack are staggered, thereby avoiding the excessive jarring at each end of the stroke, and giving an even strain on both gears. The use of two gears permits the passing of bars through an opening in the top of the column for key-seating.

The plate for shifting the belt has the slots so arranged, that one belt is shifted before the other.

The head is loosened by pushing the lever at the back of the head, and can again be instantly fastened after it is set

A 26-INCH TRIPLE-GEARED SHAPER

to the desired angle by pulling the lever toward the operator.

The shifter dogs are placed on top of the ram in a very convenient position.

All wearing surfaces are provided with flat gibs, and the screws for adjusting them are provided with lock nuts to prevent their moving. The lead screw and tool slide screw are provided with hand wheels.

The table is supported on a roller, which can be very quickly adjusted by means of the lever shown.

This machine is geared at the ratio of about 42 to 1, and is made to take very heavy cuts with high-speed steel.

The vise has a graduated swivel base,

ANY and all new or improved machines, tools, or shop appliances of interest to men responsible for results in machinery-making plants will be briefly illustrated and described here—the machine shop news.

A more full and detailed description will be given—when it is real news—if it can appear here first—before it is sent to other papers. All descriptions appear in ALL four editions of the paper—Weekly, Monthly, Weekly English and Weekly German.

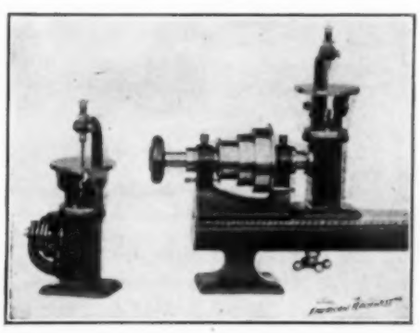
which is turned at an angle of thirty degrees, so that it can be easily read by the operator. Two additional clamping bolts are provided which project through the upper jaw of the vise, and which can be fastened where extreme accuracy is necessary, as these bolts will overcome the tendency of the upper jaw to raise when the work is being fastened.

The apron, as well as the table on this machine, is slotted on the top, thereby providing a very liberal clamping surface.

The Waltham Filing Machine

The halftone shows the handy little filing machine made by the Waltham Machine Works, Waltham, Mass.

The machine is either self-contained



THE WALTHAM FILING MACHINE

or can be mounted on the speed lathe. The table is 5 inches diameter and tilts for clearance. Stiff files can be clamped top and bottom, and slender files or diamond-charged strips can be held by drilling cross holes top and bottom and slipping the ends over pins in the frame. Files from 2 to 3½ inches long can be held. The stroke can be adjusted up to 1½ inches.

A Universal Table with Chuck

The halftone shows a table built by the William E. Gang Company, Cincinnati, Ohio.

This table is fully universal. The upper part carrying all of the operating levers describes a complete circle about the base; in addition to this the chuck can also be revolved upon its center irrespective of the angle to which it is tilted. The tilting movement is accomplished by a crank and worm. A segment of large diameter, graduated from 0 to 90 degrees enables the operator to accurately set the table to any angle desired.

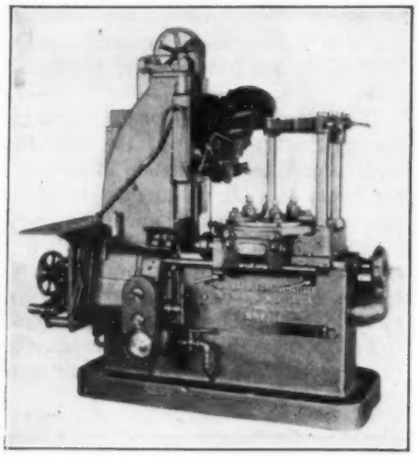
A UNIVERSAL TABLE WITH CHUCK

The three-jawed independent chuck shown is 26 inches in diameter and is adapted to hold work of a round or irregular shape. For chucking castings that are tapered both inside and outside, the jaws are made with a false front. They are also provided with a spring to keep the false jaws tilted back toward the center of the chuck so work with a tapered bore can be easily placed on the jaws, making it only necessary to loosen one jaw to remove or place the work in the chuck. The chuck jaws are reversible, and if desired the jaws can be removed, and the chuck used as an ordinary round table. A complete set of clamping levers is furnished, each at-

tached to its respective place. This table can be furnished with a plain round or square top instead of the chuck. The plain square top is 24 inches square.

Gould & Eberhardt Gear Hobbing Machine

The cut shows one of the latest gear hobbers, built by Gould & Eberhardt, Newark, N. J. This machine has been simplified and strengthened, and its operation has been made more convenient. The description which follows is applicable to two sizes of these machines, that is, the 12x6 inches, which will cut 5 pitch in cast iron and 6 pitch in steel, and



GOULD & EBERHARDT GEAR-HOBBING MACHINE

the 24x10 inches, capabable of cutting 4 pitch in cast iron and 5 pitch in steel.

The work table and indexing worm are in one piece, rigidly supported at the periphery. It can be rotated in either direction to cut right- or left-hand gears. The slide upon which it is mounted is adjustable lengthways on the bed, a vernier being provided to facilitate accurate reading of the distance from center to center of work and cutter spindles. The adjustment is by hand on the standard machine, but automatic adjustment with automatic stop can be applied at extra cost.

The outer support will swing work to the full rated capacity of the machine, and is readily swung out of the way for placing and removing work. By removing the two uprights gears of larger diameter than the rated capacity of the machine can be cut. The index worm is steel, of coarse pitch, hardened and ground, and runs in oil. Its bearings are so arranged that it can be readily disengaged from the worm wheel and the work table rotated by hand, to ascertain the truth of the mandrel and work A micrometer adjustment on the worm permits the adjustment of the work circumferentially without disconnection of any mechanism.

It is frequently desirable to take two cuts in helical gears, particularly when cutting a first gear of a size to obtain correct thickness of teeth. A patented device is furnished, whereby a recut may be taken through the same helices. A set of indexing gears is furnished to cut every number of teeth from 10 to 100, and a large number of teeth up to 400. The machine is so arranged that gears having prime numbers of teeth may be cut without requiring special gears.

Upon the stanchion is mounted a vertically adjustable cutter slide carrying a supplementary slide which can be swiveled to any angle. A special gage is provided, which is always in place on the machine, and with it the hob may be set centrally, regardless of whether there is work in the machine or not.

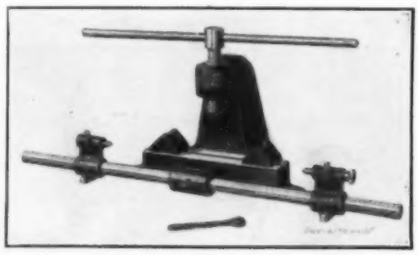
The power feed is downward for both right- and left-hand gears. The amount of feed is definite for each rotation of the work spindle.

The feed-change gears are located at the rear of the machine. The cutter speeds are obtained by means of a cone, running on a patented sleeve bearing, which takes all the pull of the belt. The countershaft is arranged so that there is a great variety of speeds obtainable at the cutter spindle.

At additional cost these machines can be arranged to cut steering gears, with thread-milling cutters, either single, double, triple or quadruple, threaded with a lead greater than 2 inches. The machine, as furnished, will take care of worms under 2-inch lead. An efficient oil pump is furnished with each machine, to allow the use of a lubricant when cutting steel. Around the bed of the machine is cast an oil pan which catches any drippings from the machine. Electric-motor drive can be readily attached to these machines, and a variable-speed motor with a ratio of three to one, maximum speed not to exceed 1500 revolutions per minute, is recommended.

A Bench Straightening Press

The cut shows the No. 1 size bench-straightening press, manufactured by the



A BENCH-STRAIGHTENING PRESS

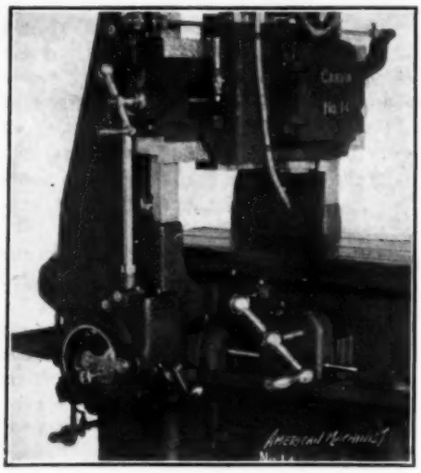
P. A. Geier Company, 5112 St. Clair avenue, Cleveland, Ohio, which will straighten cold stock up to 2 inches in diameter.

The V-blocks are easily movable along the groove in the bed and the centers are adjustable to accommodate work being done. The thrust block on the screw is of machinery steel case-hardened, and the adjustable centers are of tool steel hardened.

The body of this press is 13 inches high, length of the centering shaft 40 inches. The tool weighs 135 pounds.

Garvin Vertical Miller with Rotary Feed Box

The halftone shows a vertical-spindle milling machine equipped with the standard rotary feed box, used by the same



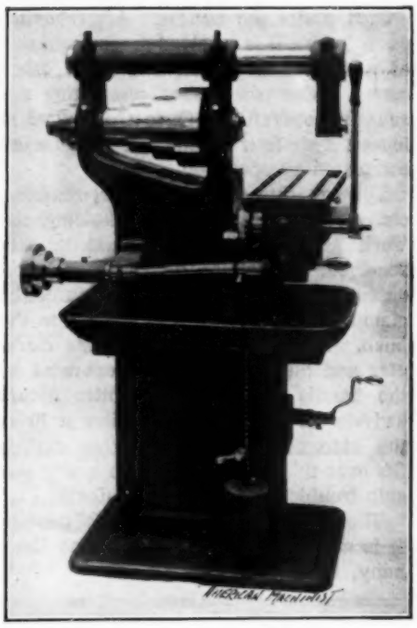
ROTARY GEAR BOX ON GARVIN VERTICAL MILLER

concern on its milling machines, which has been adapted to the requirements of the vertical-spindle milling machine. This gives 12 changes in geometrical progression, with the addition of a reverse, so as to change the direction of the feed. This feed box carries both direct to the head on the rail, or to the table feed. Should the feed for one need to be different than the other, the quick turning of the crank while the machine is in operation will bring the desired feed into play. The table and rail feed are automatic in both directions. The automatic trip to both is of a character in which the feed is thrown out slightly before the positive stop is reached, so that there can be no break down of the feed works by carelessness in setting trips. The manufacturer of the machine is the Garvin Machine Company, New York City.

A Plain Milling Machine

The halftone shows a plain milling machine, built by Bickford & Washburn, Inc., Greenfield, Mass. The feed rack is a quarter-section of a screw, and is driven by a worm wheel, driven by a short worm and gear from the feed shaft. The automatic feed can be thrown out and hand-lever feed used.

An automatic quick return is provided, by means of the weight and chain. A stop trips the return.



A PLAIN MILLING MACHINE

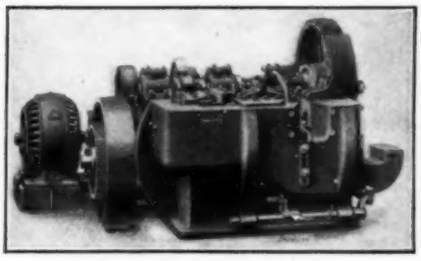
The table has a working surface 8 inches wide by 23½ inches long, it has 15 inches horizontal travel, 7 inches vertical travel and a cross feed of 3 inches. The machine weighs 900 pounds.

The National Forging Machine

The halftone shows a new National forging machine with friction-slip flywheel.

The flywheel is held between friction flanges which are keyed to the shaft. When excessive material or cold stock is fed into the machine and prevents the heading tool from completing a full stroke, the flywheel slips between these friction flanges. This slipping action dissipates the attendant excessive strains and protects not only the machine but the motor as well.

These machines are built in sizes of 1½, 2, 2½, 3, 3½ and 4 inches capacity. The illustration is of a 2-inch machine and shows the motor application and friction-slip flywheel. The builder is the National Machinery Company, Tiffin, O.



THE NATIONAL FORGING MACHINE

A 16-inch Back Geared Shaper

The halftone shows a shaper built by the Stockbridge Machine Company, Worcester, Mass., and intended for either tool-room work or manufacturing. A four-step cone and the back gears provide eight changes of speeds. The traverse and down-feed screws are graduated in thousandths. The stroke is 16¾ inches, vertical travel of table 14¾, horizontal travel 23 inches. Maximum distance from

A 16-INCH BACK-GEARED SHAPER

table to ram 17 inches, weight 2850 pounds.

New Drive for Paragon Drills

The Cleveland Twist Drill Company, of Cleveland, Ohio, has recently brought out a new device for driving flat taper shanks that are tapered both on the flat sides and round edges.

As shown in Fig. 1 the driving collet has two lugs *L L* projecting upward from a flattened disk through which is cut a rectangular hole to receive the paragon shank *A*. The lugs have rounded outside surfaces ground to standard taper and flat inner surfaces tapered to fit the flat taper shank. The groove *G* is provided to receive the point of a drift key in case the collet should stick in the spindle. When the collet is on the shank the combination is practically an interchangeable taper shank with unusually long tang. The projection *E E* is driven

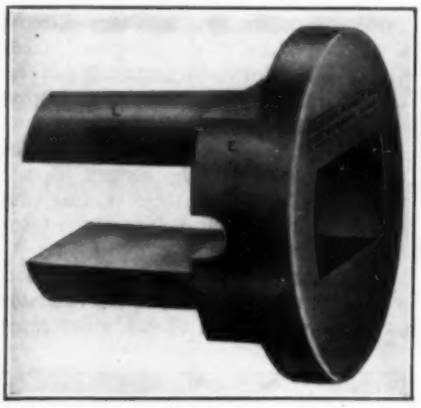


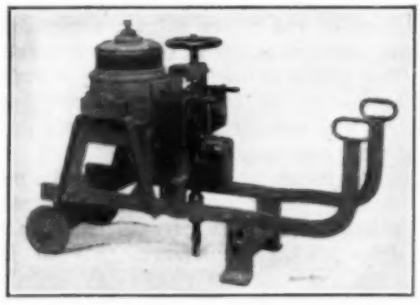
FIG. 2. THE COLLET

by the slot in the spindle. Fig. 2 shows the collet by itself.

A Portable Drill

The halftone shows a new type of electric portable drill which has been brought out by C. & E. Fein, of Stuttgart, Germany. The drilling spindle can be swung to any position between the one shown and one at 180 degrees to it.

When boring in the position shown, a plank is slipped through the two handles and the operator sits on the plank, preventing the drill under pressure from lifting the outfit.



A PORTABLE DRILL

The machine is intended for use in ship yards, bridge shops and structural iron works.

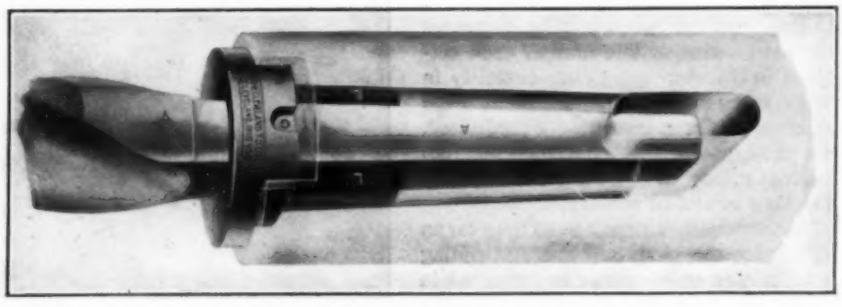


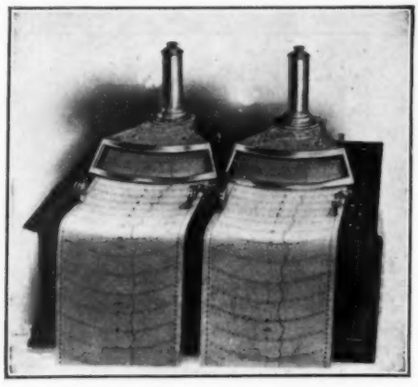
FIG. 1. THE COLLET AND DRILL IN PLACE IN THE SPINDLE

The Price Pyrometer

The halftone shows the recorder of a pyrometer made by the Price Electric Company, of Lakeview, Cleveland, Ohio.

The scales of both indicator and recorder are furnished in any range desired, up to 3000 degrees Fahrenheit, and in either Fahrenheit or Centigrade. The electrical design of the meters is such that the variation in their reading, due to change in the temperature of the room, is negligible.

The recorder consists of a movement similar in most respects, to the indicator, equipped with a roll of graduated chart



THE PRICE PYROMETER RECORDER

paper and the means for moving it under the needle. The recording process is by means of an electric spark made to jump from the end of the pointer, perforating the chart, at regularly frequent intervals. The action of the spark being entirely automatic, the annoyance of replenishing ink, usually after the supply has been exhausted, is obviated.

The couple or business-end of the pyrometer generates an electric current whose intensity is proportional to the difference in temperature between its ends.

The National Machine Recorder

The halftone shows the recording end of this machine, built by the National Machine Recorder Company, Chicago, Ill.

This machine automatically computes the net running or idle time of each machine in the shop and shows distinctly in large figures the net amount of time the machine has been producing, or if desired, the amount of idle time that has occurred at any time during the day and the total at end of the day.

Automatically allows a fixed time for an operation, recording on chart and adding wheels only such time as is consumed in excess of this given time. A glance at the recorder will indicate just which operators are not coming up to required efficiency. Idle time shown is all *avoidable* as legitimate handling time is not recorded and chart shows whether delays are due to repairs or reasons beyond operator's control.

NATIONAL MACHINE RECORDER

With the attachments the three *essentials* to increasing efficiency are obtained, namely—output, producing time, wasted time and cause.

Garvin Vertical Squaring Milling Attachment

This attachment is designed for general work in milling pieces that require a quartering index. The illustration shows the attachment holding what is known as a lather's hatchet, where the head is grooved at right angles, producing a checkered face. It is also adapted for squaring shanks of taps, reamers, bolts, studs and similar work.

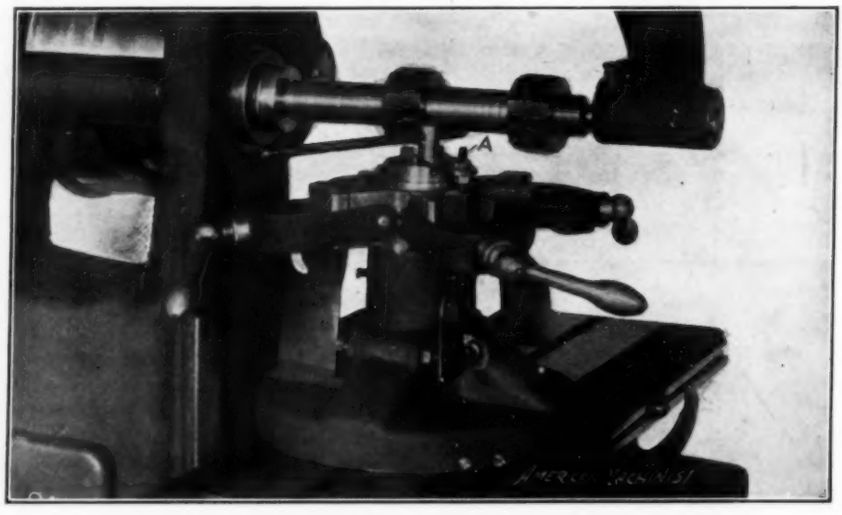
As shown for milling hatchets, the work is inserted into the fixture, under the hight gage *A*. It is a four-division index fixture, locking by means of a bolt. After the hatchet is put under the gage, and clamped by means of a binder, it is revolved one-quarter of a revolution, and passed under the cutters. After having passed once, it is revolved another quarter of a turn, and passed under the other cutter, these two passes completing the squaring operation. Once the fixture is loaded with four hatchets, each passage completes an operation.

For squaring shanks of taps, reamers, etc., the half bushings for holding the work are interchangeable and quickly removed. It will be noticed that in all cases the cut is against the fixture, the clamp merely holding the work into the bush. The index ring is of large diameter and the locking bolt is operated by the handle on top. The entire fixture swivels on a standard that has a fit to the extreme top. The rotating casting fits over this standard in such a way that chip troubles are entirely eliminated.

The weight of the fixture is 125 pounds. It is made by the Garvin Machine Company, New York.

A New Rope Belt

The Aktiengesellschaft für Seilindustrie (vorm. Ferd. Wolff), Mannheim-Neckarau, Germany, has devised a new method of rope construction which has proved valuable in service. This is a patent rope belt of thin, rhombic rope sections sewed together in a longitudinal direction and presenting a perfectly regular running surface. The advantage of this construction is that all cross-threads are avoided, whereby high tensile strength is attained. This "Epata" rope belt, as the makers call it, is elastic and has great adhesiveness to the pulley. The belts intended for shifting drills are protected by a leather edge against friction. It is stated that these belts can be used in damp rooms or in the open air.



GARVIN VERTICAL SQUARING ATTACHMENT

Concrete vs. Wood Flooring

(*Continued from page 842*)

on this put 2-inch, or better still, 3-inch planking, running crosswise with the building, and covered finally with ⅞-inch square-edge boards, preferably tongue and grooved at the ends for the finished flooring.

This gives the advantage of concrete so far as the foundation is concerned; it gives the waterproofing and preservative qualities of the pitch and tar concrete, and the advantages of wooden top floors which, while costing a little more in the beginning, will probably, in 90 cases out of 100, be found more satisfactory in the end.

I am not able to go into the relative cost per square foot for different types of flooring, for the reason that these would vary considerably in different localities, according to the relative prices of the materials at that point. In general way it might be said that the finished granolithic floor would cost around 25 to 30 cents per square foot, and a concrete floor with wood top covering, as suggested above, would figure 12 to 14 cents additional.

Increasing Shop Capacities

Metal Working

NEW ENGLAND

The Universal Boring Machine Company, Hudson, Mass., is building an addition.

The Globe Wire Nail Company, Taunton, Mass., intends to open a new plant shortly.

The Capewell Horse Nail Company, Hartford, Conn., will erect an addition to its plant.

The Leonard & Baker Stove Company, Taunton, Mass., will erect an addition to its foundry.

The Hendey Machine Company, Torrington, Conn., is putting up a new one-story erecting house.

The Modern Tool Manufacturing Company will start a shop at 107 Friendship street, Providence, R. I.

The plant of the D. W. Daniels Hydraulic Pump Company, Sherborn, Mass., was badly damaged by fire.

The Boston & Maine Railroad is preparing for the construction of locomotive and repair shops in Boston, Mass.

The Baird Machine Company, Oakville, Conn., has purchased a site for a new plant at West Stratford, a suburb of Bridgeport.

The Metal Products Company, Providence, R. I., has purchased land adjoining its plant and is considering the erection of an addition.

The Ginler Engineering Company, Worcester, Mass., manufacturing coffee and sugar plantation machinery, will move to South Framingham, Mass., where a new factory will be erected.

Harvey Hubbell, Inc., Bridgeport, Conn., is said to be seeking a location in the Far West for establishing a branch plant for the manufacture of machine tools, machine screws, etc.

MIDDLE STATES

Charles Fritz, Zanesville, Ohio, will build a three-story garage.

Wm. Gabeman, Manitowoc, Wis., will erect a garage and machine shop.

The Le Roy (N. Y.) Motor Company is building a two-story addition.

Frederick Smith's garage at Dobb's Ferry, N. Y., was destroyed by fire.

The Dayton (Ohio) Scale Company will erect a plant in Toronto, Ont.

The Newark (N. J.) Tube and Metal Works will erect an addition to its plant.

Scherer & Wadsworth, Detroit, Mich., will erect a three-story automobile factory.

The Ford Motor Company is to erect a four-story factory at Long Island City.

The Fort Wayne (Ind.) Oil Tank and Pump Company is erecting a new plant.

News items for the sales department—where more equipment will be needed. Authentic news is solicited for this department, not rumors or gossip—facts.

The Barlow Foundry Company, Newark, N. J., will build an addition to its plant.

The Goss Printing Press Company, Chicago, Ill., will erect a two-story addition.

The Dayton (Ohio) Ice Machine Company is seeking a suitable location for a plant.

The roundhouse of the New York Central Railroad, at Penn Yan, N. Y., was destroyed by fire.

The Appleton (Wis.) Iron and Metal Company is erecting a new building on Winnebago street.

The Wetmore Adding Machine Company, of Milwaukee, Wis., will probably erect a factory there.

Oscar Lear will build an automobile factory and garage at 288 East Long street, Columbus, Ohio.

The Hill Machine Company, Anderson, Ind., having outgrown its present plant, is said to be considering removing same.

The Augustine Automatic Rotary Engine Company, Buffalo, N. Y., is having plans prepared for additions to its plant.

Contract has been awarded by the Grand Rapids & Indiana Railway for the erection of a new roundhouse at Cadillac, Mich.

It is reported the Western Maryland Railroad is buying site at Connellsville, Penn., on North Eighth street for shops and roundhouse.

The McComber & Whyte Wire Rope Company, 507 South Clinton street, Chicago, Ill., is making investigation toward securing site for a plant.

The American Culm Company, 1532 Arch street, Philadelphia, Penn., is considering the erection of a new plant for the manufacture of furnaces, etc.

The Bishop & Babcock Company, Cleveland, Ohio, manufacturing brass goods, faucets, etc., is having plans prepared for a four-story addition.

Builders Hardware Manufacturing Company, Paterson, N. J., has been incorporated with $30,000 capital by G. H. Drew, G. H. Vermulen, W. J. Gardner.

The Bay View Foundry and Machine Company, of Sandusky, Ohio, has purchased additional ground near its present plant with the view of building a large addition.

The National Calculator Company, New York, has been incorporated with $60,000 capital to make computing machines. Incorporators, P. Kleeberg, C. J. Smith, B. Phillips.

The Ohio Valley Enamel Company, Pittsburg, Penn., has been organized to manufacture enamel and galvanized ware. Capital, $10,000. Incorporators, E. H. Hindley, J. R. Paull, A. J. Barrier.

The Owners Garage Company, Cleveland, Ohio, has been formed to operate a garage and repair business. Incorporators, Fred W. Ginn, Frank C. Newcomer, Gardner Abbott, etc. Capital, $15,000.

Automatic Motor and Engineering Company, Chicago, Ill., has been incorporated to manufacture engines and machinery. Capital, $100,000. Incorporators, A. C. Allen, A. E. Roof, Geo. T. Clithere.

The Mid-West Motor Supply Company, Camden, N. J., has been incorporated to manufacture automobiles, etc. Capital, $100,000. Incorporators, F. R. Hansell, Wm. F. Eidell, John A. MacPeak.

The Black Diamond Range Company, Newark, N. J., has been organized to manufacture ranges, stoves, etc. Capital, $125,000. Incorporators, Alpheus Webster, Orange; C. B. Gurney, A. Gurney, Newark.

The Cincinnati (Ohio) Iron and Steel Company has leased the plant of the Union Sheet and Tin Plate Company, at Marietta, Ohio, and will open its mill shortly for rolling merchantable sizes of sheets.

The plant of the Commercial Iron Works, at Penn Yan, N. Y., destroyed by fire some time ago, is to be rebuilt. A new company has been formed under the name of the Commercial Iron Works Company.

The Draper-Latham Magneto Company, New York, has been incorporated to manufacture magnetos and other electrical devices. Capital, $500,000. Incorporators G. O. Draper, C. J. Dannenbaum, A. C. Day.

Metropolitan Mercantile Motors, New York, has been incorporated to manufacture, sell and repair carriages, motor vehicles, etc. Capital, $50,000. Incorporators, D. Campbell, F. G. C. Lyon, H. S. Reynolds.

The Mans Bros. Auto Company, Lima, Ohio, has been incorporated to operate a sales agency, garage and repair shop. Incorporators, H. P. Mans, A. D. Mans, N. F. Hall, F. H. Mans and R. G. Alberding.

The Rensselear Valve Company, Troy, N. Y., has been incorporated to manufacture valves, hydrants, brass castings, etc. Capital, $500,000. Incorporators, E. L. Rowe, I. A. Rowe, Troy; T. Breslin, Waterford.

The Fremont Stove Company, of Fremont, Ohio, has been organized to take over the plant of the old June company at that place

and manufacture a full line of stoves. The plant will be put in shape at once.

The American Hydraulic Air Compressor Company, Milwaukee, Wis., has been organized with $500,000 capital. Incorporators, A. C. Lingelbach, A. O. Girard, R. C. Loewe. Plans are being prepared for a plant.

The Furnace Gas Consumer Company, Matteawan, N. Y., has been incorporated to manufacture and deal in appliances to control coal and gas stoves. Capital, $1,000,000. Incorporators, J. H. Lynch, J. G. Meyer, W. J. Paul.

The Universal Nut-Lock and Specialty Company, Buffalo, N. Y., has been incorporated to manufacture and sell mechanical appliances and specialties. Capital, $300,000. Incorportors, A. B. Gilette, P. J. Sullivan, J. Schmaus.

C. R. Forth and M. G. O'Brien, of Mansfield, Ohio, have closed a deal for the purchase of the plant of the Steam Shovel Company, on East Mansfield street, Bucyrus, Ohio, which will be remodeled into an automobile factory.

SOUTHERN STATES

O. P. Woodcock, Jacksonville, Fla., will erect a garage.

Imperial Motor Car Company, Nashville, Tenn., will erect a two-story garage.

The J. E. Moss Iron Works, Wheeling, W. Va., is looking for a site on which to erect a plant.

The American Telegraphone Company, Wheeling, W. Va., is removing its plant to Springfield, Mass.

Dietrich Brothers, Baltimore, Md., manufacturing structural iron and steel work, will enlarge their plant.

The National Enameling and Stamping Company, Baltimore, Md., contemplates erecting an addition to its plant.

WEST OF THE MISSISSIPPI

Benolken & Theisen's machine shop was burned at Holdingford, Minn.

The Factoria (Wash.) Stove and Range Works is erecting a new plant.

The American Culvert Company, at Albert, Minn., will erect a new factory.

Fire did $25,000 damage to the plant of the American Metal Company, La Harpe, Kan.

Smith & Hess, Los Angeles, Cal., will build a machine shop on Central avenue in this city.

Clarkson Lindley, 1518-20 Hennepen avenue, Minneapolis, Minn., will build an $18,000 garage.

Equipment will be required in the new Polytechnic High School to be erected at Long Beach, Cal.

The Oliver Iron Mining Company is removing its shops from Mountain Iron, Mich., to Coleraine, Minn.

W. G. Augustine, Los Angeles, Cal., will erect a foundry and machine shop in this city on Clara street.

GENERAL MANUFACTURING

NEW ENGLAND

Frederick A. Haskell, Providence, R. I., is enlarging his engraving plant.

The Bristol Weaving Company, New Bedford, Mass., is building an addition.

A. Sinnott, 425 Main street, Melrose, Mass., is in the market for a concrete mixer.

Great Falls Manufacturing Company, Somersworth, N. H., will build a new mill.

F. M. Provost, 177 Front street, Worcester, Mass., is in the market for a soap press.

The Fort Drummer Mills, a $500,000 textile industry, will locate at Brattleboro, Vt.

The Enterprise Dye Works, Woonsocket, R. I., will install a 100-horsepower boiler.

The Borden Shoe Company, Fall River, Mass., is considering the removal of its plant.

The Worcester (Mass.) Woolen Mills Company proposes building an addition to its plant.

The R. M. Baker Shoe Company, Salem, Mass., is to remove its plant to Portsmouth, N. H.

The Regina Lace Company, Central Falls, R. I., expects to install a lot of new machinery.

Plant of the Warren Bros., Asphalt Company, at Cambridge, Mass., was badly damaged by fire.

The Leominster (Mass.) Electric Light and Power Company is making additions to its power plant.

The Boston & Maine Railroad is preparing to equip shops at East Fitchburg, Mass., with motor drive.

The chemical plant of the Frost Finishing Company, Barrington, R. I., was burned. Loss, $22,000.

The Wolff Worsted Company will establish a plant at Harrisville, R. I. About 400 people will be employed.

The Temple-Stuart Chair Company, East Princton, Mass., will establish a factory at Baldwinsville, Mass.

George Lawley & Co., South Boston, Mass., large boat builders, are considering the removal of their plant.

Two buildings of the Rutland Florence Marble Company, West Rutland, Vt., were destroyed by fire.

The Rockwood Sprinkler Company, Worcester, Mass., is purchasing tools for a new factory. Will buy electric motors.

Chas. O. Normandy, shoe manufacturer, Norridgewock, Me., is interested in a new shoe factory and is seeking a suitable location.

The factory of the American Hatters and Furriers Corporation, and that of the Connecticut Glue Company, a subsidiary concern, Danbury, Conn., were destroyed by fire. Loss, $150,000.

The Greylock Manufacturing Company, North Adams, Mass., has acquired two more plants which will be equipped with cotton machinery.

The Rhode Island Street Railway Company, Providence, R. I., intends to double the capacity of its largest power station. Will expend $300,000. A 20,000-horsepower steam turbine engine will be installed.

MIDDLE STATES

Gaspar Genova, Newburgh, N. Y., will erect an ice-cream factory.

H. W. Wright Lumber Company will build a new plant at Merrill, Wis.

The Mosaic Tile Company, Zanesville, Ohio, will build a new power house.

Drone & Co., flour mills, Zanesville, Ohio, will install some new machinery.

Potsdam, N. Y., will vote on the question of installing a waterworks system.

The Newton (N. J.) Gas and Electric Company will build a new power plant.

The Goodwillie Company, Manistique, Mich., will enlarge its box factory.

The Kiel Furniture Company, of Milne, Wis., will erect a $53,000 addition.

A lighting plant will be built at the Montgomery Court House, Palatine, N. Y.

The Seneca Power Company, Baldwinsville, N. Y., will erect a power house.

Roberts Bros., Warsaw, N. Y., are erecting a six-story flour mill at Batavia, N. Y.

The plant of the Davis Worsted Company, Manayunk, Penn., was destroyed by fire.

The Waverley Paper Box Company, Newark, N. J., will build a $15,000 addition.

The Genesee Pure Food Products Company, Le Roy, N. Y., is building a new factory.

Fire destroyed the plant of the Novelty Dye Works, Milwaukee, Wis. Loss, $25,000.

Voltz Bros., Chicago, Ill., carriage manufacturers, will erect a new two-story factory.

The Oneita Knitting Mills, Utica, N. Y., is building an addition to its spinning department.

The Brooks & Ross Lumber Company will rebuild its mill, at Schofield, Wis., recently burned.

The bookbinding plant of A. S. Wickwire, at Deposit, N. Y., was destroyed by fire. Loss, $100,000.

Rice Lake (Wis.) Milling Company's plant at Rice Lake, Wis., was destroyed by fire. Loss, $30,000.

The Lima (Ohio) Mattress Company has awarded contract for the erection of a new $30,000 factory.

The Iroquois Brewing Company, Buffalo, N. Y., contemplates erecting a $150,000 addition to its plant.

The C. Moerlein Brewing Company, Cincinnati, Ohio, is having plans prepared for a $70,000 bottling plant.

Warehouse of American Manufacturing Company, Greenpoint, N. Y., was destroyed by explosion of boilers.

The plant of the American Plate Glass Works, at James City, Penn., was destroyed by fire. Loss, $1,000,000.

The Smaltz-Goodwin Company, Philadelphia, Penn., manufacturing shoes, will erect a new $150,000 building.

The Green-Hoas-Schwartz Company, Cleveland, Ohio, manufacturing knit goods, is erecting a six-story building.

The Ensmingen Lumber Company has built a large new mill at Harrisburg, Penn., and will equip same in the spring.

The Federal Knitting Mills Company, Cleveland, Ohio, is erecting a large mill to take care of increased business.

The American Straw Board Company, Quincy, Ill., will build an addition to be used for the manufacture of egg cases.

The North Star Egg Case Company, Quincy, Ill., is planning an addition for the manufacture of straw-board paper.

The town of Batavia, N. Y., is constructing an addition to the water station and will install additional pumping machinery.

Samuel Charlton will establish at Highland Falls, N. Y., a modern newspaper plant, presses to be operated by motor power.

The Fred Alden & Sons Company, Ladysmith, Wis., will rebuild its woodworking and enameling plant at Bruce, destroyed by fire.

Fire destroyed the Youngblood & Harris coal elevators and Wilbur Van Fleet's lumber yards at Middletown, N. Y. Loss, $20,000.

The Fifth Avenue Railway and Light Company, Columbus, Ohio, proposes to erect a power house on West Fifth avenue, near the Hocking Valley tracks.

The Allentown Spinning Company has awarded contract for the erection of a $70,000 mill at South Second street and the Erie Railroad, Lakeview, N. J.

The Hygienic Ice Company, Chicago, Ill., has been incorporated to manufacture ice. Capital, $200,000. Incorporators, H. J. Aaron, Albert Bettcher, Adolph Weinstein.

The Scioto Box Company, Columbus, Ohio, has been incorporated to manufacture and sell boxes, crates, cases and files. Incorporators, John A. Ford, G. S. Ferguson, M. A. Church, etc. Capital, $20,000.

The Empire Rubber Company, Cleveland, has been incorporated to manufacture and sell all kinds of rubber articles. Incorporators, Frank R. Howells, John F. Christian, Carl W. Parker, etc. Capital, $250,000.

The Valley Furniture and Manufacturing Company, Marietta, Ohio, has been organized to manufacture furniture and wooden articles. Incorporators, George P. Reelman, Jacob Reelman, Joseph P. Ward, etc. Capital, $40,000.

The Sharp Spark Plug Company, Cleveland, Ohio, has been incorporated to manufacture and sell spark plugs and other automobile accessories. Incorporators, J. F. Johnson, F. D. Johnson, John Sharp, etc. Capital, $70,000.

Proposals will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until 11 a.m., December 3, for two 300-horsepower boilers, piping, economizer, boiler-feed pumps, motor generator set, etc., for the Naval Station, New Orleans, La. R. C. Holbyday is chief of the bureau.

The Navy Department, Bureau of Supplies and Accounts, Washington, D. C., will open bids November 8, for 30 arc lamps, two 1-horsepower constant-speed motors, seven 10-kilowatt transformers (schedule 3017), 24 dozen cotter files, 12 pneumatic chipping hammers, 12 dozen alundum wheels (schedule 3020), 300 tons steel castings (schedule 3014), brass and cast-iron pipe fittings, brass gate valves (schedule 3021); November 22—Steel nuts and bolts, expanding mandrels, copper tubing (schedule 3029).

SOUTHERN STATES

The Bamberg (S. C.) Cotton Mills Company is said to be preparing to enlarge its plant.

The city of Sarasota, Fla., contemplates issuing $20,000 bonds for waterworks, etc. J. Louis Houle, city clerk.

The Pickett Cotton Mills, High Point, N. C., incorporated some time ago, has completed arrangements for the erection of a plant.

The Independent Ice and Fuel Company, Jacksonville, Fla., a new concern, will erect an ice and cold-storage plant. J. T. Butler, president.

The Seaboard Pipe Foundry Company, Savannah, Ga., has plans prepared for a new plant, to consist of main shop, machine shop and tapping room, etc.

The Hammond Knitting Company, Hammond, Md., has been incorporated by E. H. Friend, H. O. and Fred Friedlander to manufacture knit goods. Capital, $10,000.

WEST OF THE MISSISSIPPI

A system of waterworks will be installed at Madison, Minn.

W. F. Geddes, Los Angeles, Cal., will erect a modern warehouse.

The Cedar Rapids (Iowa) Brick Company's plant was destroyed by fire.

The Park Brewing Company, Winona, Minn., will erect an addition.

The city of Hearne, Tex., will vote on issuance of bonds for waterworks.

F. M. Webb, Los Angeles, Cal., will build a planing mill on South Rio street.

The Bisbee Light and Power Company, Bisbee, Ariz., will enlarge its gas plant.

The Central Lumber Company, of Aberdeen, S. D., will erect a two-story mill.

The city of Ada, Okla., will vote on issuance of $100,000 bonds for waterworks.

The city of Corning, Cal., has voted bonds for $70,000 for a water and sewer system.

The National Lumber Company, Pomona, Cal., is building an addition to its plant.

A barley and feed-milling plant will be erected at Porterville, Cal., by J. A. Rigby.

The Domestic Water Company, Redlands, Cal., is making improvements in its system.

The city of Covina, Cal., has voted bonds for $70,000 to install a modern sewer system.

C. Thomson, of Rapid City, S. D., will erect a cold-storage plant at Main and Fifth streets.

The city of Monrovia, Cal., will install a new water and sewer system to cost $170,000.

The city council, at Mitchell, Ore., has voted bonds for $7000 for a water system.

The Pacific Home Building Company, Los Angeles, Cal., will soon erect a large planing mill.

The Los Angeles Box and Basket Factory, at Hermosa Beach, Cal., is enlarging its plant.

The Antill pumping plant, property of the city of San Bernardino, Cal., is being improved.

The plant of the Utah Ice and Cold Storage Company, Salt Lake City, will be enlarged.

The Ventura Power Company, Ventura, Cal., is making improvements in its water system.

The city of Long Beach, Cal., contemplates the installation of a high-pressure water system.

The Turlock irrigation district, Turlock, Cal., will make improvements in its irrigating system.

The Luverne (Minn.) Brick and Tile Company is making additions and alterations to its plant.

Goodrich Bros., of Ida Grove, Iowa, will install a refrigerating system at their packing plant.

A vote will be taken on November 15, for $40,000 in bonds to erect a gas plant at Newton, Iowa.

J. J. Sommans, Pasadena, Cal., will erect an art glass factory. Modern equipment will be installed.

The Truckee Water and Light Company, Truckee, Cal., will make improvements in its power house.

The Water Users' Association, Phœnix, Ariz., will erect a large power plant near Tempe, Ariz.

G. W. McFee, Riverside, Cal., is planning an irrigating system for his property in that section.

F. L. Lindenburger, Winchester, Cal., will install a pumping plant for his property in that section.

The city of Huntington Beach, Cal., will install a municipal sewer system to cost about $30,000.

An irrigation and waterworks system is being planned for Del Mar, Cal. It will cost about $15,000.

The Eugene (Ore.) Heating and Power Company is building a central heating plant to cost $7500.

The Clarksville (Tex.) Light Company will rebuild its electric-light and power plant, recently burned.

The National Lumber Company, Alameda street, Los Angeles, Cal., is building an addition to its plant.

R. A. Baker & Co. will build a rock-crushing plant on their property, Arroyo Seco, South Pasadena, Cal.

Heating equipment will be required in the new city hall at Pomona, Cal. H. A. Reeves, Los Angeles, architect.

The Manual Arts High School, Los Angeles, Cal., will install a complete shaving exhaustc and incinerator system.

The Capital City Lumber Company, St. Paul, Minn., will erect a sash and door factory at Midway, Minn.

The Rubicon Water and Power Company, Georgetown, Cal., will soon commence work on its new power house.

The Nevada, California and Oregon Telephone Company contemplate the erection of a plant at Alturas, Cal.

The city of Ontario, Cal., will vote on bonds for $175,000 for a municipal waterworks and sewer system.

The Southern California Lumber Company, San Pedro (Los Angeles), Cal., is building an addition to its plant.

The Southern Oregon Power Company, Lakeview, Oregon, will install a modern 10,000-horsepower power plant.

The Covina Irrigating Company, Covina, Cal., contemplates expending $150,000 in extending its irrigating system.

The Los Angeles Ice and Cold Storage Company will erect a modern cold-storage plant at San Bernardino, Cal.

The American Biograph Company, of New York City, will erect a factory at Pico and Georgia streets, Los Angeles, Cal.

The Loon Lake Water and Power Company, Georgetown, Cal., is planning for extensive improvements in its power plants.

W. T. Carter, of Houston, Tex., will erect a $200,000 sawmill at Camden, Tex., to replace the one burned some time ago.

F. A. Dickson, Los Angeles, Cal., will erect a modern warehouse at Sixteenth street and Griffith avenue. Uptodate facilities will be installed.

The Holley Electric Company, Portersville, Cal., has acquired a power site near Springville, and will soon commence the erection of a plant.

The Southwestern Sugar and Land Company, of Phœnix, Ariz., will erect a beet-sugar factory at Calexico, Cal., to cost $1,000,000.

The Great Western Power Company will build a station in the Sabino Cañon, near Tucson, Ariz. The project will cost $1,500,000.

Announcement is made that the city of Albany, Ore., has granted a gas franchise to P. G. Lowe, and that a plant will immediately be erected.

The Northern California Power Company, Redding, Cal., is building a new power plant at Battle creek, an offspring of the Sacramento river.

A heating and ventilating system will be installed in the new school building to be erected at Bairdstown, Cal. Plans are now being drawn.

Announcement is made from Moctezuma, Mexico, that the Mesa Roca Gold Mining Company is preparing to install a modern cyanide plant.

Announcement is made that the city of Sacramento, Cal., will issue bonds for over $600,000 for the installation of a municipal filtration plant.

Marshal Brothers have purchased the city pumping plant at Perris, Cal., from Hock Brothers, and contemplate making improvements in same.

J. L. Webb will install a modern pumping plant on his newly acquired ranch, near Tia Juana. The Harris Realty Company, San Diego, is his agent.

F. L. Pogue and H. Mitchell, of Phœnix, Ariz., will erect a power plant in the vicinity of Globe, Ariz., for supplying this district with water and power.

Wichita, Kan., is building a new high school, which will be thoroughly equipped for manual training, including mechanical drawing and wood work.

The Aldine Canning and Preserving Company, Aldine, Tex., recently formed, will erect a plant. Main office address is Box 76, Station A, Houston, Tex.

Heating and manual-training equipment will be required in the new high school to be erected at Monrovia, Cal. Allison & Allison, Los Angeles, Cal., architects.

The Power Transit and Light Company, Bakersfield, Cal., will erect a power plant to cost $400,000. J. G. White & Co. have been engaged as construction engineers.

The Mojave River Land and Water Company (L. M. Holt, Los Angeles, Cal.) will make extensive improvements in its irrigation system at San Bernardino, Cal.

Announcement is made from Bozeman, Mont., that a gas franchise has been issued to Messrs. McCarthy & Schroeter, of that city. Operations on a plant to cost $100,000 will soon begin.

The Southern California Chemical Company (a new incorporation of the Braun Chemical Company), Los Angeles, Cal., will erect a manufacturing plant at Vernon, Cal., to cost $100,000.

The Santa Fe Springs Hotel and Sanitarium Company, of Los Angeles, Cal., will erect a modern hotel at Santa Fe Springs (near Los Angeles). About $150,000 will be expended. Equipment will be required.

A. G. Smith, Globe, Ariz., has organized the Gila Valley Electric, Gas and Water Company, with capital stock of $100,000. A site has been selected for a power house in the Graham mountains, near Safford, Ariz., and operations will soon begin.

CANADA

Norcross Bros. are erecting a large marble-working mill at Toronto, Ont.

J. J. Flaherty, of Quebec, will erect a large shoe factory in Winnipeg.

W. H. Kreyscher will locate a large shingle mill and box factory at Nelson, B. C.

The Montreal Street Railway will equip a large power house at Youville, Quebec.

The Empire Brewing Company is building a large brewery at Brandon, Manitoba.

The Ives Modern Bedstead Company is building a new factory at Cornwall, Ont.

D. A. Leach, of Sunbridge, will locate a large veneer plant at North Bay, Ontario.

The Edmonton Soap Company will equip a $200,000 factory at Edmonton, Alberta.

The Shawinigan Cotton Company will locate a large new factory at Shawinigan Falls, Quebec.

Sherbrooke, Quebec, will buy stone crushers and machinery for building a large new reservoir.

The Toronto (Ont.) Electric Light Company is spending $150,000 on extensions to its plant.

Winnipeg, Manitoba, plans to spend $10,000,000 for new waterworks extensions and machinery.

The East Pubnico Amusement Company is erecting a large power house and substation at Halifax, N. S.

The Beaufort Silk and Cotton Company will equip a large new plant at Beaufort, Quebec, with the latest machinery.

The Monarch Knitting Company will locate a new factory at St. Thomas and install $30,000 worth of the latest machinery.

F. J. Roberts, of Niagara Falls, will undertake the building of a large power plant in the Porcupine district, probably at Sandy Falls.

Business Item

The United Engineering Company, experts in manufacturing methods, designers of special machinery, press tools, jigs, fixtures, inventions developed, etc., has opened large offices and drafting rooms in the Warner building, Bridgeport, Conn. E. R. Abbott, formerly with Joseph Merritt, Hartford, Conn., is manager.

Trade Catalogs

Barber-Colman Company, Rockford, Ill. Circular. Gear hobbing machine. Illustrated.

Halcomb Steel Company, Syracuse, N. Y. Catalog. "Ketos" tool steel. Illustrated, 40 pages, 4½x8 inches.

Goldschmidt Thermit Company, 90 West street, New York. Pamphlet. Thermit process of rail welding. Illustrated, 16 pages, 6x9 inches.

Emerson Apparatus Company, 251 Causeway street, Boston, Mass. Pamphlet. Plant inside micrometer caliper. Illustrated, 6 pages, 3½x6 inches.

Webster & Perks Tool Company, Springfield, Ohio. Catalog. Bolt pointing, threading and special tapping machinery. Illustrated, 30 pages, 6x9 inches, paper.

Forthcoming Meetings

National Society for Promotion of Industrial Education, fourth annual convention, Boston, Mass., November 17, 18 and 19.

American Society of Mechanical Engineers, annual meeting, December 6-9, New York. Calvin W. Rice, secretary, 29 West Thirty-ninth street, New York City.

American Foundrymen's Association, annual convention, Pittsburg, Penn., May 23 to 26, 1911. Richard Moldenke, secretary, Watchung, N. J.

American Society of Mechanical Engineers; monthly meeting second Tuesday. Calvin W. Rice, secretary, 29 West Thirty-ninth street, New York City.

Boston Branch National Metal Trades Association. Monthly meeting on first Wednesday of each month, Young's hotel. D. F. S. Clark, secretary, 141 Milk street, Boston, Mass.

Providence Association of Mechanical Engineers. Monthly meeting fourth Tuesday each month. E. C. Bliss, president, 91 Sabine street, Providence, R. I.

New England Foundrymen's Association; regular meeting second Wednesday of each month, Exchange Club, Boston, Mass. Fred F. Stockwell, 205 Broadway, Cambridgeport, Mass.

Engineers' Society of Western Pennsylvania; monthly meeting third Tuesday. Elmer K. Hiles, secretary, Fulton building, Pittsburg, Penn.

Superintendents' and Foremen's Club of Cleveland; monthly meeting third Saturday. Philip Frankel, secretary, 310 New England building, Cleveland, O.

Western Society of Engineers, Chicago, Ill. Regular meeting first Wednesday evening of each month, excepting July and August. Secretary, J. H. Warder, 1735 Monadnock block, Chicago, Ill.

Philadelphia Foundrymen's Association; meetings first Wednesday of each month, Manufacturers Club, Philadelphia, Penn. Howard Evans, secretary, Pier 45 North, Philadelphia, Penn.

WANTS

Rate 25 cents per line for each insertion. About six words make a line. No advertisements abbreviated. Copy should be sent to reach us not later than Friday for ensuing week's issue. Answers addressed to our care, 505 Pearl street, New York, will be forwarded. Applicants may specify names to which their replies are not to be forwarded, but replies will not be returned. If not forwarded, they will be destroyed without notice. No information given by us regarding any advertiser using box number. Original letters of recommendations or other papers of value should not be inclosed to unknown correspondents. Only bona-fide advertisements inserted under this heading. No advertising accepted from any agency, association or individual charging a fee for "registration," or a commission on wages of successful applicants for situations.

Miscellaneous Wants

Caliper catalog free. E.G.Smith, Columbia, Pa.

Test indicators. H. A. Lowe, Cleveland, O.

B. Jahn, New Britain, Conn., makes dies, tools, models and specialties.

Special machinery and tools designed and detailed. Box 146, AMERICAN MACHINIST.

We buy or pay royalty for good patented machine or tool. Box 282, AMER. MACHINIST.

The "Gas Saver" brazing forge; circular. J. L. Lucas & Son, 2 Fox St., Bridgeport, Ct.

Wanted—Work for screw machines and gear cutter. Box 775, AMERICAN MACHINIST.

Wanted—Medium weight specialties or contract work. Wm. A. Cather, Pottsville, Penn.

Light, fine machinery to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

If you want special machinery or tools designed, I can give you satisfactory service. Box 39, AMERICAN MACHINIST.

Light and medium weight machinery and duplicate parts built to order; tools, jigs, etc. MacCordy Mfg. Co., Amsterdam, N. Y.

Will purchase interest in going concern and take active management of shop or office. Address "Stephens," AMERICAN MACHINIST.

Patents. C. L. Parker, Patent Attorney, ex-examiner Patent Office, 990 G St., Washington, D. C. Write for Inventor's Handbook.

Wanted—Automatic screw machine work, up to and including 9/16-inch diameter, for latest multi-spindle machines; prompt deliveries and reasonable prices. Woburn Gear Works, Nashua St., Woburn, Mass.

Large English firm of machine tool importers having showrooms and offices in Great Britain, France, Germany, Italy, India and Japan is wanting good agencies for machine tools of all kinds. Box 189, AMER. MACH.

Those breaks on power plant or machinery! Are you going to lose time awaiting new parts from makers, or will you let us weld them at one-fourth to three-eighths cost of replacements? Reshipment within 24 hours. Oxyacetylene process, producing homogeneous weld of cast iron. No charge unless successful. Waterbury Welding Works, Waterbury, Conn.

Help Wanted

Classification indicates present address of advertiser, nothing else.

CONNECTICUT

Foreman Wanted—First class, uptodate man, experienced in steam engine work, to take charge of boring and planing machines, and also erecting work. Apply by letter to the Terry Steam Turbine Co., Hartford, Conn.

DISTRICT OF COLUMBIA

United States Navy wants machinists; pay $44 to $77 per month, clear of living expenses, with splendid chance for promotion to warrant machinist at $1200 to $2100 per year; the life is healthy and different forms of athletics are encouraged; the food is wholesome and plentiful, and the opportunity to save money and see some of the United States and foreign countries is excellent. Send for free illustrated booklet which tells all about navy pay, play, promotion, etc. Address Bureau of Navigation, Navy Department, Washington, D. C.

MASSACHUSETTS

Head draftsman and designer, experienced on rotary printing presses and folders. Box 132, AMERICAN MACHINIST.

Experienced salesman wanted to travel from Boston to Chicago selling an extensively advertised and popular machine tool; state salary desired and past experience in selling. Box 109, AMERICAN MACHINIST.

NEW JERSEY

Wanted—By a manufacturer of electrical apparatus, dynamos, motors and accessories, a first-class shop superintendent; plant employs about 200 men; applicant must be a thorough manager and of first-class executive ability; it will also be necessary for him to make an investment proportionate to the salary he will receive; a good salary will be paid to the right man. Box 119, AM. MA.

NEW YORK

Mechanical draftsman and designer; opportunity of lifetime with young aggressive manufacturing corporation (where advancement is limited only to the individual ability) for an especially apt, well trained man who has served as chief draftsman with prominent concerns; experienced in ventilating and conveying installations essential; give nationality, age, places and periods of employment, salary expected, etc. Box 129, AMERICAN MACHINIST.

Foreman Wanted—A well equipped modern shop in vicinity of New York City manufacturing light machinery and instruments in large lots, desires general foreman; must be thoroughly acquainted with modern practice, including automatic and hand screw machines, and able to work with cheap help; to a man occupying such a position and producing results a good proposition is open; will not consider a man out of a position; all replies confidential. Box 116, AM. MACH.

Ventilating Engineer—Young phenomenally successful corporation manufacturing labor-saving equipment, is interested in an arrangement with an acknowledged expert in the designing and building of exhaust fans, dust arresters, etc.; must be situated conveniently to New York, where counsel could be had readily; if of advantage consultation could be arranged evenings and holidays; state age, education and experience. Box 130, AMERICAN MACHINIST.

OHIO

Wanted—First-class foreman for tool and jig department in machine tool works; give age, experience and wages expected. Cincinnati Bickford Tool Co., Cincinnati, Ohio.

Wanted—A first-class draftsman capable of designing intermediate sizes of heavy iron working machinery; work will probably require six months time; state experience, salary expected, etc., care of "N. I.," AM. MA.

Wanted—An experienced man as foreman of gear cutting and milling department, by concern manufacturing iron working machinery; state experience, age and salary expected, addressing reply care of "D. H.," AMERICAN MACHINIST.

Wanted—First-class machinists, toolmakers die sinkers, lathe, planer, drill press, screw machine, boring and milling machine operators, wood patternmakers, brass molders, polishers, buffers, finishers, spinners, millwrights, hammermen and blacksmiths who are seeking positions or desirous of improving on those which they have, to register their names and addresses with the free Employment Department of the National Metal Trades Association. Address Commissioner's Office, 605 New England Bldg., Cleveland, O.

PENNSYLVANIA

Wanted—A first-class locomotive draftsman; one with experience in designing; state salary expected. Box 75, AMER. MACHINIST.

Machinist, first class of wide experience, required as inspector on machine tool work; state age, experience and salary expected. Box 77, AMERICAN MACHINIST.

Wanted—Instructors in mechanical engineering in an eastern institution; graduates from technical schools, preferably with one or two years' experience. Address with references, Box 115, AMERICAN MACHINIST.

Wanted—Master mechanic and superintendent for knitting machine shop, on new and repair work; steady habits, mechanical and executive ability essential; experienced knitting machine man preferred; permanent position and good salary to right man. Box 810, Reading, Penn.

The Monotype School is maintained to train young men to meet the constant demand for operators of our type casting and composing machine; these operators do so well that we receive more applications for places than can be filled; these qualifications carry most weight: Common sense, automatic machinery experience, printing office experience, type foundry experience. Full particulars will be furnished to inquirers who furnish the same information about themselves, and mention this paper. Lanston Monotype Machine Co., Philadelphia.

SITUATIONS WANTED

Classification indicates present address of advertiser, nothing else.

CONNECTICUT

Wanted—Situation as draftsman or shop foreman; at present employed as foreman; desire change. Box 149, AMER. MACHINIST.

Designer, experienced on automatic machinery for wire and sheet metal novelties; also jigs and fixtures, practical shop experience. Box 122, AMERICAN MACHINIST.

A foreman familiar with Gridley, Potter & Johnston, Universal and Hartford automatics and Jones & Lamson, and chucking machine work, desires a change. Box 136, AM. MA.

An A-1 tool room foreman, excellent reputation, expert on tool and die work, thoroughly experienced in manufacturing by up-todate methods, would like to locate at once. Box 103, AMERICAN MACHINIST.

ILLINOIS

Toolmaker, experienced on repairs to automatic screw machines, turret lathes, gear cutters and other first-class machinery, with knowledge of drafting and layout work, 20 years' experience, desires position. Box 135, AMERICAN MACHINIST.

Wanted—Position as superintendent or assistant, thoroughly conversant with piecework and uptodate methods of manufacture of interchangeable work; have had 18 years of general shop practice; A-1 organizer. Box 89, AMERICAN MACHINIST.

MASSACHUSETTS

A-1 production man, estimator, tool designer and speed boss. Box 100, AMER. MACH.

Assistant superintendent or general foreman; A-1 tool and machine designer; can get maximum output from equipment; age 34. Box 99, AMERICAN MACHINIST.

Responsible position wanted by a practical shop man, expert toolmaker and designer of special machinery and equipment, with wide experience. Box 58, AMERICAN MACHINIST.

Superintendent; age 38; first class executive and highly successful manager of men; practical mechanic; now employed; highest references. Box 125, AMERICAN MACHINIST.

Young man, specialist on cost work, production man and systematizing; at present and for several years employed by large manufacturing concern; A-1 references. Box 121, AMERICAN MACHINIST.

MICHIGAN

Superintendent or factory manager open for first-class connection with reliable concern; am thoroughly experienced in the manufacture of small and medium sized machines, typewriters, etc.; understand the application of modern methods to the management and organization of a factory; highest references. Box 138, AMERICAN MACHINIST.

NEW JERSEY

General foreman, 39, now engaged, accustomed to modern methods of manufacture, desires change. Box 61, AMERICAN MACHINIST.

Gas producers, gas, oil and steam plants, land and marine, I can sell, design installations, superintend erection and run trials; shop and office experience in four countries; expert draftsman. Box 133, AMER. MACH.

Wanted—Position as manager, or assistant manager of machine tool plant or machine shops, or would put experience against capital in a partnership; over 19 years' experience as machinist, toolmaker, foreman, inspector, demonstrator on road, estimator, designer, chief draftsman and assistant engineer; age 36; permanent position only considered; salary $2500; I can make good. Box 48, AM. M.

NEW YORK

Draftsman, designer, experienced, seeks position. Box 144, AMERICAN MACHINIST.

Mechanical draftsman wishes position; five years' experience on special machinery design. Box 124, AMERICAN MACHINIST.

A-1 draftsman and machinist desires position as draftsman or shop foreman; extensive experience; references. Box 150, AM. MACH.

Chief draftsman, mechanical engineer, 37, 16 years steam, gas, hydraulic and automatic machinery, desires change. Box 140, AM. M.

Draftsman, special machine and tool designer, interchangeable parts; 10 years' experience; location immaterial. Box 141, AMERICAN MACHINIST.

Mechanical engineer, with extensive shop practice, thoroughly versed in designing and handling large machine shop, foundry and erection, desires position. Box 143, AM. MA.

First-class tool and diemaker, age 28, experienced at sheet metal drawing, forming, bending, with executive ability, wishes to make change; reference. "Hustler," AM. M.

Machinist, tool and diemaker; A-1 on experimenting, designing and developing special tools and machinery; 10 years' foremanship experience; good executive ability. Box 134, AMERICAN MACHINIST.

Mechanical engineer, expert designer, with ten years' broad practical experience; resourceful and good executive; position with manufacturer or consulting engineer as engineer or superintendent desired. Box 139, AMERICAN MACHINIST.

Foreman or superintendent; German-American; experienced in the rapid production of interchangeable parts, tools, dies, clock and instrument work; good executive; location New York or New Jersey; good references. Box 137, AMERICAN MACHINIST.

Diemaker, A-1 mechanic, capable to design and build the most uptodate dies, expert on drawing dies, wishes position as foreman; 20 years' experience; five years foreman over die and press room; will go anywhere in the East or Middle West. Box 142, AM. MA.

General superintendent, hustling and aggressive; can crowd the work out, reduce costs and raise billing; expert at tools, dies, machinery, drafting, accurate estimator; experienced at contracting machine work and meeting price; past record will convince before closing. "Mechanical Engineer," AM. M.

OHIO

Mechanical engineer, 12 years' experience, desires position as manager or superintendent of production. Box 145, AMER. MACHINIST.

Graduate engineer, several years' experience as head designer in live motor truck firm, desires change. Box 126, AMER. MACHINIST.

Superintendent, desires position; first-class organizer, with executive ability; expert designer of high-class dies, jigs, tools, etc.; excellent references. Box 128, AMER. MACH.

Tool room foreman; first class expert on designing the most modern and uptodate methods of high class diemaking, jigs and tools, etc.; good organizer with executive ability; excellent recommendations. Box 127, AMERICAN MACHINIST.

PENNSYLVANIA

Superintendent or factory manager, thoroughly familiar with the economical manufacture of interchangeable parts for medium and heavy machinery. Box 148, AM. MACH.

General foreman is open for a position as superintendent or general foreman; 32 years old, with good education; 12 years of experience as tool and diemaker on all kinds of tools and dies and manufacturing systems in the gun, adding machine and electrical line; guarantee to get results; correspondence to be mutually confidential. Box 120, AMERICAN MACHINIST.

WISCONSIN

Foreman of drafting and tool room, die and jig designer; expert on designing and making dies for automobile stampings, executive ability; American; 38. Box 123, AM. M.

General superintendent or works manager is open for engagement; high class and aggressive; good organizer and systematizer; can produce maximum results from minimum expense; advertiser is 42 years old, has had 20 years of successful experience as a mechanic and manager of manufacturing establishments. Box 131, AMERICAN MACHINIST.

FOR SALE

For Sale—Complete set of patterns and blueprints for five horsepower horizontal gas engine. Box 147, AMERICAN MACHINIST.

For Sale—Acme automatic screw machines, practically new; over supply of one kind only reason for selling; condition guaranteed—One No. 51, ¼ inch; one No. 52, ⅜ inch; one No. 53, 1 inch; one No. 54, 1½ inches; write for prices. Box 93, AMERICAN MACHINIST.

An opportunity to start a machine shop; we offer one of our departments for sale, the one used to establish our business; it is small and profitable work, but as we are devoting ourselves to heavier work, we offer to sell for $2000, all the drawings, patterns, and stock of finished and partly finished parts and rough material (inventories over $3000), circulars, electrotypes, special machinery and fixtures, and an established trade. Address Sipp Machine Company, Paterson, N. J.

Talks With Our Readers

By the Sales Manager

Wouldn't it be great if we had as good memories as some give us credit for?

I called on a manufacturer a short time ago. Told him plainly that his advertising was not doing him one-half as much good as it should. That he was only getting publicity whereas he could get this *plus* advertising—there's a big difference, you know.

He said that there wasn't anything particularly new to say about his machine.

I asked him a few questions, looked at his catalog, at his machine, and found it fairly bristling with real selling points.

I pointed these out. He said everybody knew all about that.

I asked him how he knew? When did they find out?

He said he ran some ads giving this information—and I found that these appeared in 1904, six years ago!

This manufacturer was so wrapped up in his own business, he knew so much about his own machine that he thought this knowledge was shared by all.

He failed to see that his machine was only one of many that went into his customers' shops—that it was a mere incident in his customers' business affairs.

Unless we are manufacturers of lathes, boring mills or planers, these machines are of no particular interest to us. We will not fill our minds with details of them.

They are only a means to an end.

What we are particularly interested in is making and selling our own product.

That's the big tent to us—all else are side shows.

Too many manufacturers advertise to *themselves* and not to their *customers.* That's one of the greatest drawbacks to present-day advertising.

The best salesman is the one who puts himself in his customers' shoes, looks at the proposition from their standpoint.

The nearer an advertisement is to an honest AA-1 salesman the better the advertisement.

Generally speaking, we mechanically inclined people are a hard-headed lot. We don't fall at the first shot.

We look at things from all sides, the top and bottom, before deciding. We are worse than the fellows from St. Louis.

We must be shown, and we want the information when we want it—not yesterday or tomorrow, but when we need it.

That's why the Selling Section of the AMERICAN MACHINIST is so helpful to the live wires in the machine-making field. It will be more so when more manufacturers appreciate this, when more readers use it as they do the other tools of their trade.

* * *

Only reliable products can be continuously advertised.